XL6000M

MATTRESS

PANEL

QUILTER

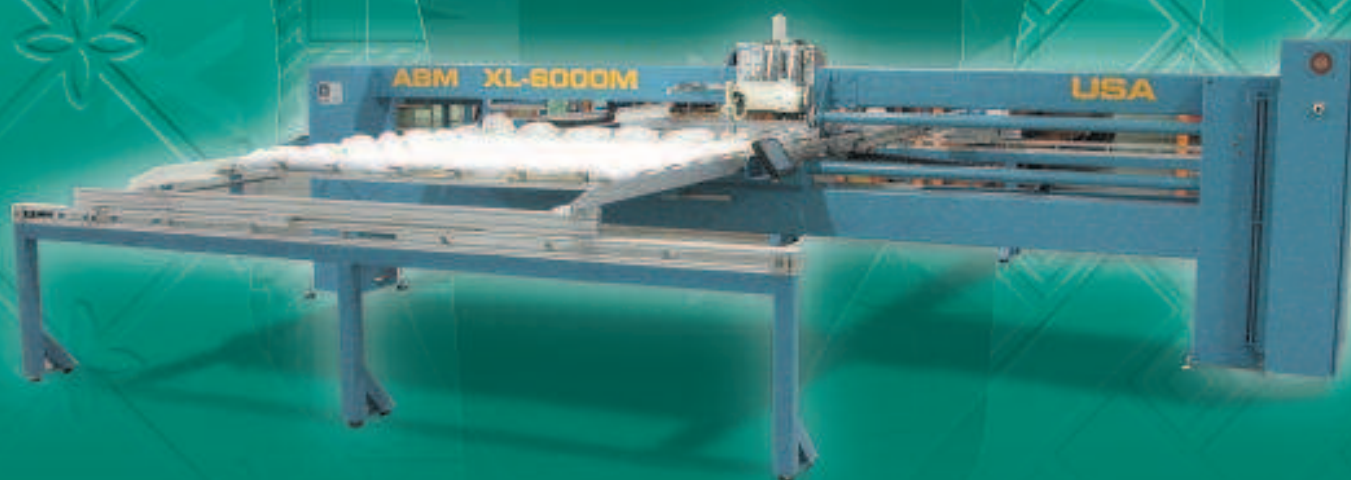ABM XL-6000M

USA

XL6000M

Computerized Mattress Quilting Machine Manual:
Version: Emerald Series
www.abminternational.com

- ◆ Installation instructions
- ◆ Operational guide
- ◆ Troubleshooting guide
- ◆ Parts list

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TABLE OF CONTENTS:

Figure 0.1 – XL6000M Computerized Quilter

Introduction

ABM International would like to thank you for the purchase of an XL-6000M Computerized Quilting Machine. ABM is confident that this machine will meet or exceed your expectations for cost, speed and durability.

If at anytime you experience problems with any of your ABM machines we ask that you contact us - 24 hours a day by calling our service department at (281) 443-4440. We can help you solve the problem quickly, and correctly. Your calls, questions, and comments will in turn help us to perfect the quality of our products and services in the future.

Once again, we thank you for your purchase.

ABM International, Inc.

Engineering Department

Section 1: Safety

1.0 Safety Introduction

As with the operation of all machinery, safe operation of the XL6000M is a major concern of ABM International, Inc. The purpose of this section is to inform personnel of the safe and prudent operation of an XL6000M.

We have attempted to recommend the most effective methods and calculations to warn against actions that could result in personal injury, or make equipment unsafe. It is important to understand that ABM cannot anticipate, or list all conceivable safety methods and warn of all the possible hazards. In the interest of promoting safety, ABM advises that the operating personnel should always make sure that personal safety and the safe operation of the machine will not be adversely affected by their actions.

It is imperative that the operating personnel of the XL6000M read and understand the information in this manual before operating the machine.

1.1 Safety Policy Statement

The conservation of the assets of any company, which include the buildings, equipment, supplies and inventories as well as personnel, must be and is the responsibility of all levels of management. The purpose of a personnel and property conservation program is to insure that all phases of management recognize that personnel and property conservation are both inseparable parts of a company's objective…to produce quality products at the lowest possible cost.

Safety of personnel in every aspect must be of first consideration. The implementation of a conservation program will eliminate human suffering and effectively lower the direct and indirect costs resulting from employee injury. It will substantially reduce the exposure and probability of damage and / or loss of company's physical assets.

1.2 Safety Practices

The safety factors must be observed to ensure safe operation of the XL6000M.

1. Read and understand the operating instructions of the XL6000M before operating.
2. Use extreme caution when working around the XL6000M electrical controls.
3. Keep hands or other body parts away from the moving parts of the XL6000M.
4. Wear appropriate personal safety protection.
5. Stop the XL6000M immediately at any sign of malfunction or danger.
6. Do not crawl under or into the XL6000M for any reason during the operation of the machine.
7. Do not reach into the XL6000M at any time during the operation of the machine.
8. Do not climb, walk, or stand on the XL6000M at any time.
9. Do not tamper with factory installed guards and or safety devices.
10. Never operate machinery without all ABM installed guards and safety devices intact, and in working order.

11. Before starting the XL6000M, ensure that no loose tools, bars or parts are lying in or on any part of the machine.
12. Proper fire fighting equipment should be kept in good operating condition and kept near in the event of fire.
13. Never attempt to service any of the pneumatic components until the unit is relieved of all air pressure.
14. Never attempt to service any part of the machine with the power on.
15. Always disconnect the power when working on the machine.
16. Do not wear loose clothing or jewelry when operating the XL6000M.
17. Always keep hair from coming in contact with moving parts.

SECTION 2.0 – Machine Setup

The XL6000M ships fully tested ready to operate. As a result, this manual provides a section on machine setup so that you can install the machine. Please read this manual in its entirety and follow all ABM instructions, especially the inspections. Total setup time, less power and air hook-up, should take approximately 6 hours.

SETUP INSTRUCTIONS:

INSPECTION #1: Upon receipt of the machine, check to ensure that there is no visible damage. Figure 0.1 and the front cover of this manual are enough for this inspection. **Note: that some components may be in different locations depending on the version of the machine.**

Determine the location in your facility for the quilting machine. Attach the eight (8) machine legs supplied with the machine to the end stands that were used to bolt the machine to its skid. Level and position the machine in the desired location. Though not required, ABM recommends that the machine be bolted to the floor. Place the rails stands in front and rear of the machine on the floor install Five (5) machine legs and level. Carefully, place the Y rails in position and attach with supplied bolts be extra careful not to damage the wires and connections. Make all necessary airline connections and low voltage connections on the rails.

Run a 220 -235VAC line single phase (25AMP) to the machine location. ABM does not recommend the use of any type of extension cord to power the machine. As with any machine, power should be run through approved conduit and ducting with proper termination. ABM does not supply a main power disconnect with the machine and recommends that the customer install one. You may connect the power to the machine at this time.

Voltages below 210 volts AC or above 240 volts ACmay generate servo alarm failures, which may cause damage to the amplifiers or motors. Such damage is not normally protected under factory warranty.

Failure to provide a proper Earth ground rod and connection may void your factory warranty.

Plumb the machine with an air line capable of at least 100psi. ABM recommends that an air line of no less than .5 inches diameter be used for supply air. **NOTE: DO NOT CONNECT AIR TO MACHINE YET. UNTIL PROPER ELECTRICAL FUNCTION IS CONFIRMED. CONNECTING POWER AT THIS TIME CAN POSSIBLY RESULT IN INJURY.**

INSPECTION #2: Will confirm that the electronics of the quilting machine are functioning properly.

WARNING: ELECTRICAL SHOCK HAZARD. THIS INSPECTION WILL REQUIRE POWER TO BE ON WHILE THE ELECTRONICS CABINET IS OPEN. IF A PROBLEM IS FOUND, YOU SHOULD NOT ATTEMPT TO REPAIR IT WITH THE POWER ON. DISCONNECT THE MACHINE PRIOR TO ADJUSTING ANY COMPONENTS WITHIN THE ELECTRICAL CABINET.

Step one; open the electronics cabinet located at the end of the horizontal beam of the machine. The internals of the cabinet will look like Figure 1.0. From left to right the components are as follows: IIS Emerald servo controller, main power disconnect, power supply, circuit breakers, terminal blocks, X amplifier, Y amplifier, Z amplifier .

Figure 2.0 – Electrical Panel.

Upon power up, the motion controller should have the symbol (A.) and the touch screen should power up to the main menu. If a different screen is visible, contact ABM for technical assistance. If (A.) is not visible on the motion controller, check the incoming power and circuit breakers for proper supply.

INPUT INSPECTION: From the main menu on the touch screen display press the maintenance button and enter your password. At the maintenance parameter screen press the I/O button. Once in the I/O screen you may test all the functionality of the machine. Depress and release the red stop button and see if the led on the touch screen changes to green. Now depress the start button and see if its corresponding led turns to green. Repeat this procedure for all the external operator buttons and check to be certain all connections are functioning properly.

WARNING – **WHEN CONNECTING AIR TO THE MACHINE, YOU MUST ENSURE THAT THERE ARE NO LOOSE ITEMS SUCH AS TOOLS FOOD DRINKS ETC. ON THE MACHINE AND THAT ALL PESONNEL ARE CLEAR OF THE MACHINE.**

The machine is now ready for the air connection. When the air is turned on, the presser foot should lift and the frame locks should open. (see figure 2.1). Adjust the pressure regulator so that a pressure reading of 90-100 psi is visible on the gauge.

OUTPUT INSPECTION: Depress the frame lock button on the touch screen and see if the frame locks actuate. Depress the oil pump and manually pump oil to the sewhead to make certain it is adequately lubricated. Repeat this procedure and test all the output buttons making sure that all features of the quilting machine are functioning properly.

If both the inputs and outputs have checked out, the electronics cabinet should be securely closed.

Figure 2.1 – Air Input location and Pressure adjustment

Inspect the entire machine and ensure that all bolts are tight and that there are no obstructions in the movement path of the machine. Check to ensure proper alignment of the rails and that the mechanical linear drives move freely.

Step 1: Load a comforter frame with a comforter in it.

Step 2: At the operator screen press the size change button. The machine will move across both it's X and Y axis and measure the frame.

Step 3: Choose a pattern from the load pattern screen. The machine will automatically scale the pattern to fit.

Step 4: Slide the speed button to 25% and test the machine at a safe reduced speed.

Step 5: Properly thread the sewing head and needle.

Step 6: Press the start button and make your first quilt.

Now check the proper functions of the buttons.

Step 1: Depress and release the stop button and test to see if the machine stops in the middle of the pattern.
.

Step 2: Depress the rethread button. The machine should return to the home positions and the operator can rethread the needle.

Step 3: Depress the restart button and the machine should return to where the operator stopped the machine. This procedure is the same as in a thread break where the thread sensor stops the machine. If you press this button again the machine will back up through the pattern in 12" increments.

Step 4: Depress the start button and the machine will begin sewing again.

Setup and inspection is now complete.

Fig. 2.2 Operator start stop station

SECTION 3.0 – Troubleshooting guide

This section is included to help diagnose and solve any problems that may occur with the XL6000M. ABM has done its best to include as much information as possible. However, not all problems are listed, therefore ABM asks that whenever a problem occurs you contact a service technician at our home office. To reach service dial 281-443-4440 and ask for a service technician, they are on call 24 hours a day, seven days a week.

Electrical power:

The XL6000M runs on a 20 amp, 220VAC supply line. The PLC, inputs and outputs (valves) run on 24Vdc produced by the power supply found in the cabinet. The PLC has its' incoming power fused through a terminal block found inside the cabinet. A fuse with a 1/2A rating is standard.

Pneumatic systems:

The pneumatic system of an ABM XL6000M is very straightforward. The system consists of a valve block with four (4) valves, two cylinders for frame locks, one pneumatic oil pump for the sewhead, one cylinder to lift the presser foot, one cylinder to fire the thread trimmer and one (1) filter/regulator combo unit.

Valve block: a device used to distribute air to multiple valves from a common location. The valve block on the XL6000M has four (4) valves and a 25-pin connector for communication to the PLC. See figure 3.1.
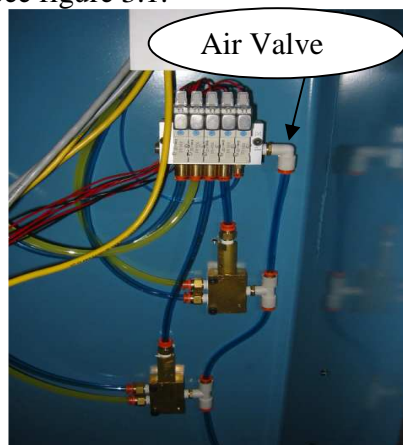

Figure 3.1 Air valve

Valve (individual): A valve is a device found on the valve block that is operated individually through the motion controller. It is possible to manually cycle an individual

valve by depressing the small orange button located directly on the valve. A small screwdriver or a pen may be needed to depress the button properly. Removal of a valve for service is accomplished by loosening the small socket head cap screw located directly above the valve, and gently pulling the valve out away from the manifold. Installation is made by reversing the above procedure.

Cylinders: The cylinders are uneconomical to repair and thus any damage that may occur to a cylinder should be rectified by replacing the cylinder.

Filter/regulator combo unit: The combo unit is the machines last line of defense against foreign materials (water, steel particles, etc.) found in a facilities pneumatic lines. The machine can be run without a combo unit but serious damage can occur to the valve block and cylinders. The combo unit also performs the task of regulating the incoming air pressure. Air pressure on both the compression and ejection cylinders is individually adjustable. Pressures should be set according to machine demand. Lower pressures may cause the machine to function improperly.

Figure 3.2 Air filter combo unit

Linear drive: The linear drive is a device that moves the frame in both the X and Y directions. It transfers power by a polyeurathane timing belt from the motor to create motion.

Fig. 3.3 Linear Drive

4.0 Maintenance

The XL6000M computerized quilter rarely requires servicing if the proper preventative maintenance if performed. There may be the unlikely event when the equipment suffers a failure. In the unlikely event of this happening, follow the outline included in this section to best determine the cause of the problem.

4.1 Maintenance Schedule

1 week after initial start-up:

1. Check all nuts and bolts for tightness
2. Check all electrical connections and tighten.
3. Check all belts for proper tension
4. Check the oiling system for proper lubrication.

Daily:

1. Wipe off the machine and clear the bridge of any clutter.
2. Check the sewhead for wear.
3. Replace the needle.
4. Check the hook and bobbin case for wear.
5. Ceck the frames to ensure all screws are tight.
6. Visually inspect the machine for loose connections.

Weekly:

1. Clean the sewhead and remove any thread wrapped around the take-up lever.
2. Clean the hook area and remove any thread wrapped behind the hook.
3. Visually inspect the frame changing table for wear.
4. Check air hoses for leaks.

Monthly:

1. Check all belts for proper tension.
2. Grease pillow blocks.
3. Check all couplings and pulleys for wear or loose screws.
4. Check all nuts/bolts/screws for tightness.
5. Check oil reservoir for oil level.

Troubleshooting notes:

A few blank pages are provided so that you and your personnel can keep records and notes of machine problems. By using this section and keeping it attached to the manual, you will always have your own personalized quick reference repair section.

TROUBLESHOOTING NOTES:

Date	Problem	Solution

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SECTION 5.0 – Parts List

This section lists the ABM part numbers needed to order any part on the XL6000M. The section is divided into two lists. Both lists show the quantity, item description and ABM part number for all the components needed to completely rebuild a machine. ABM carries all of the components below in stock at all times. Any order placed before 6:00 P.M. CST can be shipped the same day for next day delivery. The parts/service department can be reached at (281)443-4440. As with any machine, buying the correct parts from the correct manufacturer will allow your machines to operate their best. Buying parts from sources other than ABM will void your warranty.

Mechanical Components:
Following spreadsheet.

ABM INTERNATIONAL

XL6000M Quilter

EMERALD SERIES

INSTRUCTION MANUAL

ABM INTERNATIONAL, Inc.

Revision - A
Approved By:

TABLE OF CONTENTS

1.0   DESCRIPTION

The XL6000M is a Servo controlled   sewing machine that is used in the textile industry. This machine is capable of sewing various quilt patterns that are supplied to the machine in a G-code machine format. An IIS MSC-250 dual axis motion controller controls all Servomotors.

1.1   PURPOSE

The purpose of this document is to describe the operation of software packages SFO-3251 and 3252. These applications work together to direct the overall operation of the XL6000M.

SFO 3251 is an application written in the IIS Macroprogramming language.
This application contains the necessary routines to direct the operation of the MSC-250 during sewing and other various tasks.

SFO-3252 is a front-end application written in Visual BASIC 3 as an operator interface. This is an application that is loaded into a touch screen to provide the operator with various command buttons and menus to direct the operation of SFO 3251.

This manual will provide an overview of the Hardware that is used with the MSC-250 and SFO 3251 but will mainly focus on the front end Application (SFO 3252).

1.2 REQUIREMENTS

MEDIA:	3-1/2" disk
FORMAT:	IBM PC format
MSC DEVELOPMENT SOFTWARE:	Macropro
PROGRAM NAME:	SFO3251.PRG
	SFO3251.MCM
	SFO3251.SYM
	SFO3251.DBG
	SFO3251.ERR
Visual BASIC Application:	XL6000M#.exe
	Patdll.dll

2.0   XL6000M OPERATING SYSTEM OVERVIEW - The XL6000M operating system is the main operating interface between the touch screen and the MSC-250

2.1   MAIN SCREEN

When the XL6000M operating system is loaded, the un-initialized MAIN screen appears.

This screen has the INITIALIZE button highlighted. In order to access any other screen the XL6000M system must be initialized. This done by selecting the INITIALIZE button.

The Initialization process consists of two individual checks. First, the needle is energized and if no fault occurs a check appears in the Sewing Head Initialized box in the STATUS screen. (To view the status, select the STATUS button. The STATUS box and the different states are discussed later in section).

The Initialize routine is followed by the frame moving in a diagonal direction towards the opening of the frame until the X and Y limit sensors are tripped.

THE MAIN SCREEN - Continued

This position is remembered by XL6000M and used as machine zero.
If a "Rethread" position has been saved, the XL6000M will then move the frame to the preset Rethread position within the sewing area.

If this entire procedure is successful, a check will appear in the XY Initialize box of the STATUS screen. The Initialize procedure is only necessary on first power up after loading software or when a fault occurs and requires operator to re-initialize the machine.

When the XL6000M system is properly initialized the MAIN screen appears as **Figure 2.1b**.
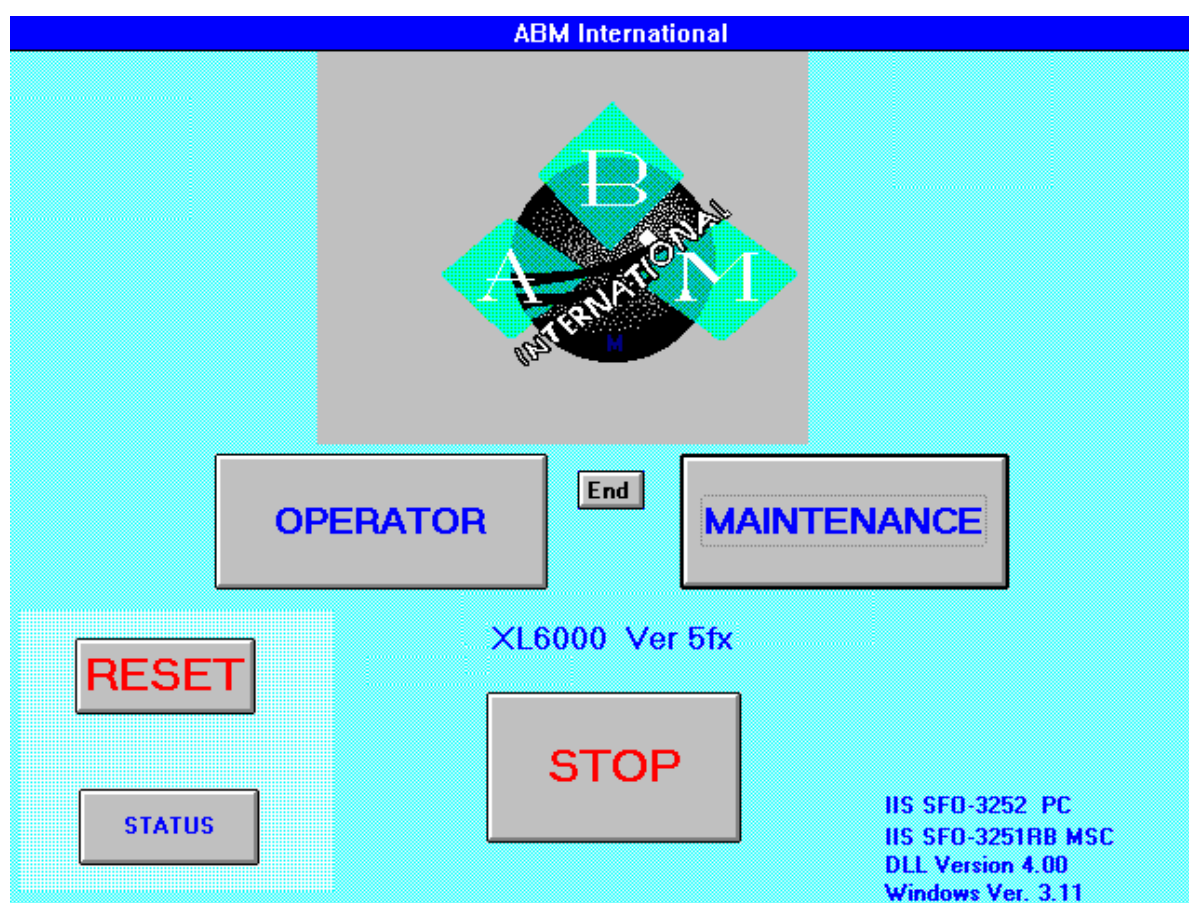
Figure 2.1b - The Initialized Main Screen

This screen shows the OPERATOR and MAINTENANCE buttons. Notice the INITIALIZE button is no longer visible. This screen also displays that the software revisions of the VB, MacroCode and the current DLL version.

The DLL is the program that allows the translation of Pattern G-Codes to a format that the MSC-250 understands.

The **RESET button** is used to clear any errors that may occur while in this screen.

The **STOP button** is used to interrupt the initialization process.

The **MAINTENANCE** button is used to enter the maintenance screen to change operating parameters.

This screen is password protected. Operating parameters for the patterns should be set up by the Technical personnel and should not have to be changed during normal operation. These screens are discussed in the Maintenance section.

Selecting the **Status button** will bring up the following screen, which is the normal running screen used for comforter sewing.

2.2   THE STATUS SCREEN

This screen shows the current state of the XL6000M system. The **Status button** is available on all screens.

The system Faults and the state of operation can be determined from this screen. The faults or current operating states are checked when that condition is in effect.
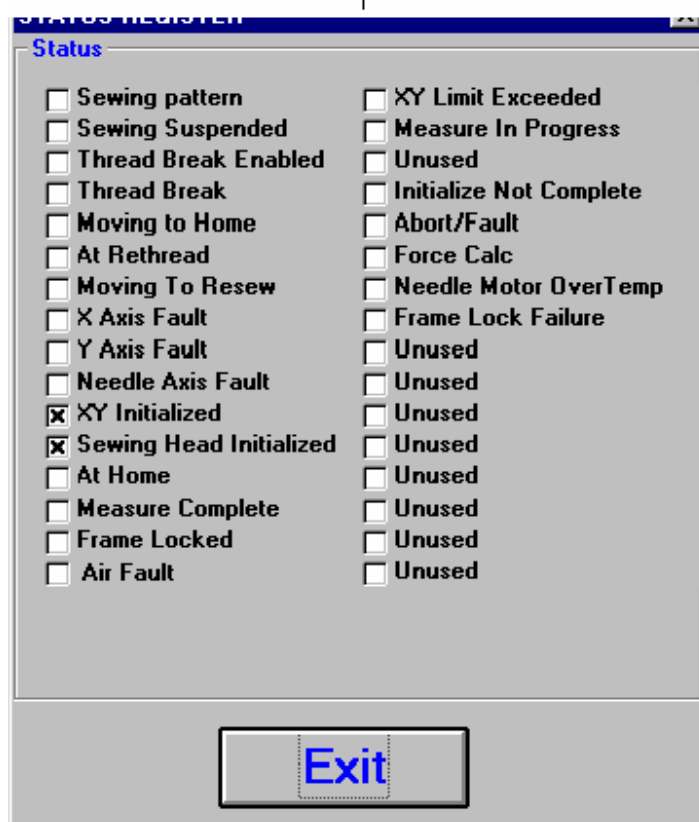
The Status and Mode settings are as follows:

Sewing Pattern:

This box will appear checked during normal sewing operation while a pattern is being sewed

Sewing Suspended:

Any time the machine is stopped during sewing, this box becomes checked. This can occur if there is a thread break, a sensor is tripped, or the stop button is pressed, etc.

Thread Break Enabled:

The *PARAMETER* screen has a parameter to set the Thread cut delay. The delay can be from 0 to 2000 milliseconds. If this parameter is not 0, this box becomes checked.

Thread Break:

When XL6000M senses that the thread has broken this box becomes checked.

Moving To Home:

This box becomes check while the XL6000M is moving to the unload rethread position.

Moving to Re-Sew:

This box becomes checked when the machine is moving to the restart position.

X Axis Fault:

If the X-axis servo motor faults, this box becomes checked.

Y Axis Fault:

If the Y-axis servo motor faults, this box becomes checked.

Needle Axis Fault:

The needle also has its separate servo and when it faults, this box becomes checked.

XY Initialized:

When the position of the sensors in the horizontal and vertical planes has been determined, this box becomes checked. Sewing will not take place until these sensor positions are known.

Sewing Head Initialized:

The initialization process attempts to turn the bobbin and to energize the sewing needle. If this process is fault free this box becomes checked. Sewing will not take place until this box is checked.

At Home:

When the operator selects the **HOME** button from the **OPERATORS** panel, XL6000M will move to the rethread position. When it gets there, this box becomes checked.

Measure Complete:

After a frame measure has been completed the **Measure Complete** box is checked.

Air Fault:

Compressed air is used to sequence the bobbin, activate the thread cutter, and open and close the Frame locks. These are I/O outputs that are displayed in the *I/O* screen.

XY Limit Exceeded:

If the frame attempts to move beyond the X or Y limit switches, an XY Limit Exceeded box becomes checked.

Measure in progress:

When the operator selects the frame measure button, this box becomes checked and will stay checked until the operation is complete.

Unused:

This status is currently not in use.

Abort/Fault:

If any Fault appears, this Box becomes checked.

Force_Calc:

This box becomes checked for the following reasons:
1. If any of the settings in the *Parameter* screen are changed, this box becomes checked. These parameters are:
> Any of the Border Offsets
> The state of Auto Border changes
> The Xborder or Yborder distance changes
> The Linear Acceleration changes
> The Minimum Sew Speed changes

2. When the frame of the sewing area changes:
3. When the maintenance personnel enters the I/O screens for any reason
4. When the maintenance personnel changes the X or Y Scaling factors
> NOTE: Changing settings 2 and 4 will force a frame measure.

Needle Overtemp:

There is a temperature sensor on the needle motor. If the motor reaches a temperature that would damage the motor a fault occurs and this box becomes checked.

Frame Lock Failure:

If both cylinders don't close properly while the sewing frame is being secured, a fault will occur and this box will become checked.

2.3 **THE OPERATOR SCREEN:** Selecting the **OPERATOR button** will bring up the following screen, which is the normal running screen used for comforter sewing.
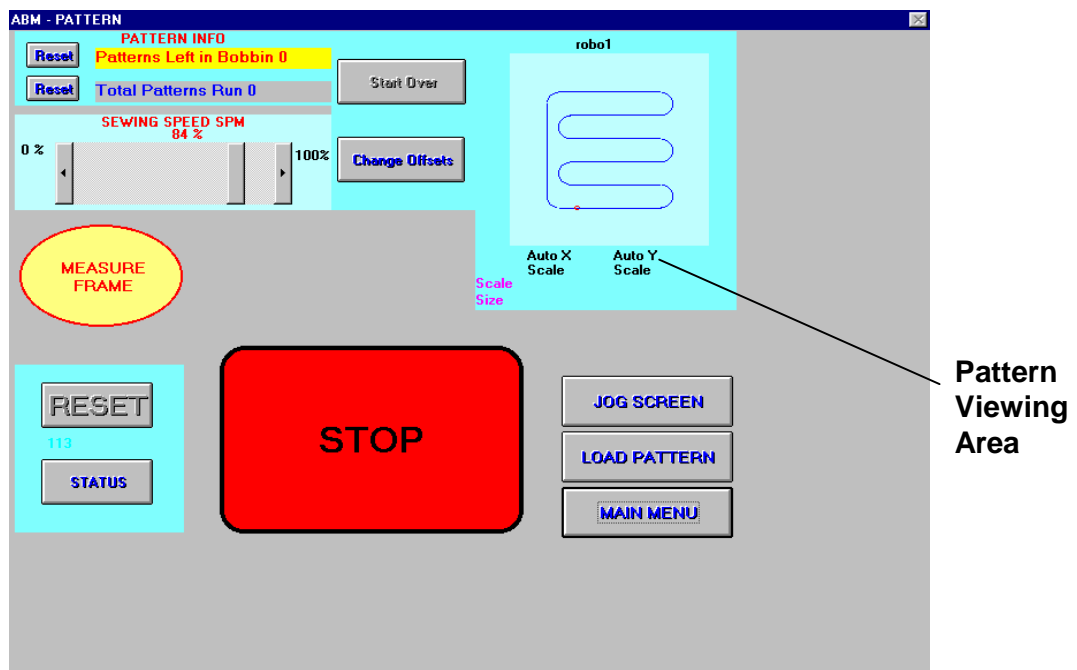
Figure 2.3a - The Operator Screen

Operator Screen Options: (refer to figure 2.3a)

The Pattern info area displays how many patterns per bobbin are left. The starting value is set in the Maintenance Parameter screen.

The next value is the total patterns run. Each of these values can be reset by using the corresponding buttons.

The **Sewing speed** is displayed in stitches per minute. This value consists of a percentage of the maximum value set in the parameter screen.

Start Over Button – During normal operation, sewing can be started and stopped at any given time. If the machine stops by selecting the Stop Button or a thread break the machine will restart and continue sewing the pattern.

Selecting the **Measure Frame** button initiates the measure frame process, which is followed by a pattern download to the MSC-250 controller.
The frame is measured from the initialized point to the farthest sensor in both the X and Y directions.

The **Reset Button** performs the same function as in the Main screen. If there is status fault this button will appear red.

A description of the fault can be viewed by selecting the **Status Button**.

The **Stop Button** stops the machine to a point where sewing can be resumed.

Pressing the **Start Over Button** causes the machine to restart sewing from the pattern home position.

The **Change Offsets** button is used to change the sewing offsets. The sewing offsets can also be modified in the Maintenance Parameter screen.

In the **Pattern viewing area**, a picture of the pattern selected is displayed as well as scaling information. If manual scaling is used the operator has the option to adjust the scaling directly from this window.

The pattern scaling has a range from 4 to 12. 12 being a 120% of the actual size of the pattern.

After a successful frame measure has been completed, the **Run Screen button** will appear.

2.4   THE RUN SCREEN – To enter the Running screen; select the **Run screen button** from the operator menu.
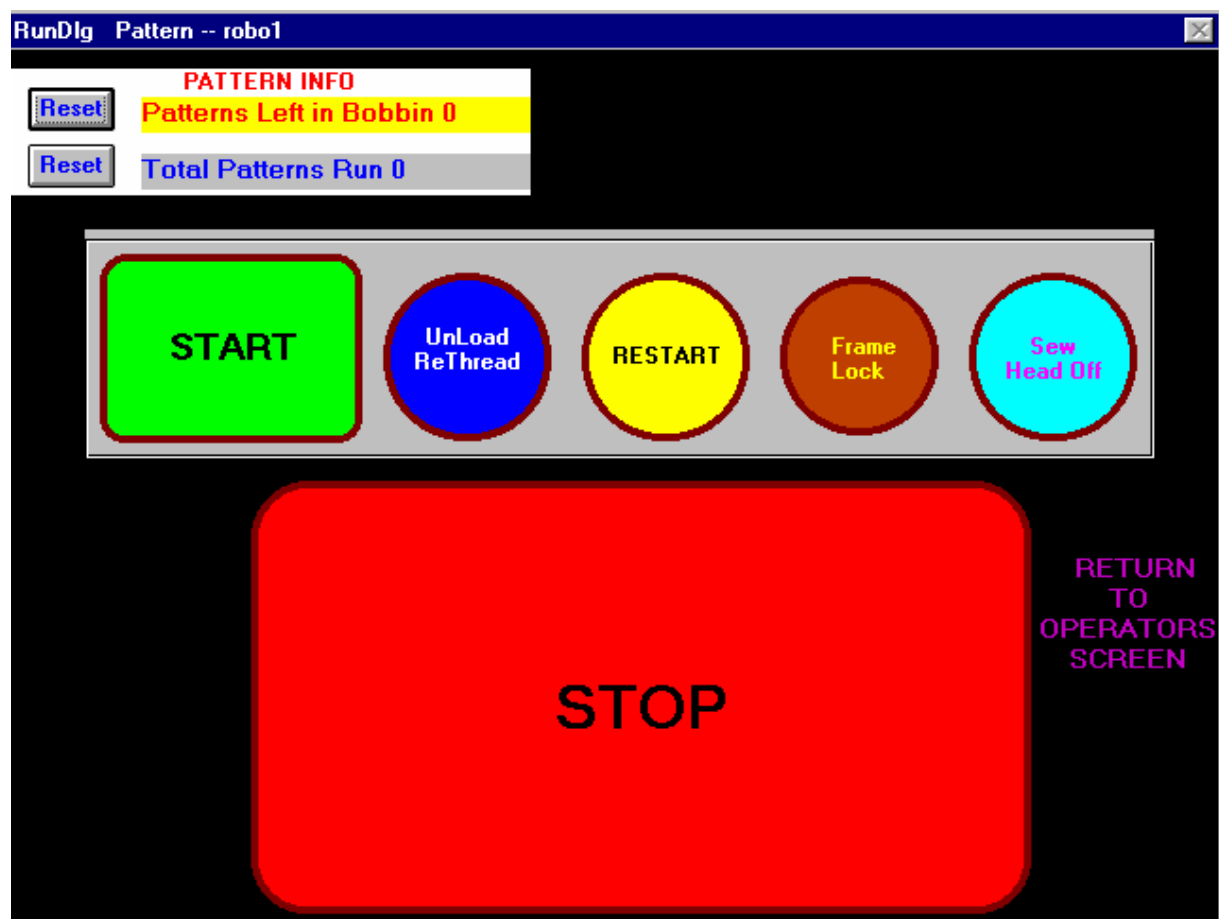
Figure 2.4a - Running Screen

In this screen there is no **Status button**. If a fault occurs, a message will be displayed indicating the nature of the fault

Run Screen Options (Refer to figure 2.4a)

The **Pattern Info** serves the same purpose as it dose when you are in the Operator screen.

The **Start Button** begins the sewing of the pattern.

The **Unload Rethread button** sends the frame to the position as it was set in the Jog screen.

The **Restart button** comes in handy after a thread break. After the thread has been reloaded, the operator can use the **Restart button** to back up in 12-inch increments through the pattern to the exact location where thread break took place. Following this procedure the operator can resume sewing by pressing the start button.

The **Frame Lock button** when pressed will engage or disengage the frame lock solenoids.

The **Sew Head Off button -**Engages or disengages the sew head
Using the feature the operator is able to simulate sewing with running the sew head. This prevents damage to the sew head during a machine setup.

To return to the operator screen touch area labeled Return **to Operators Screen.**

From the operator screen select the **Jog Screen button** to enter the **Jog Screen**.

2.5   **The Jog Screen**- Selecting the JOG SCREEN button allows the operator to enter the JOG screen.
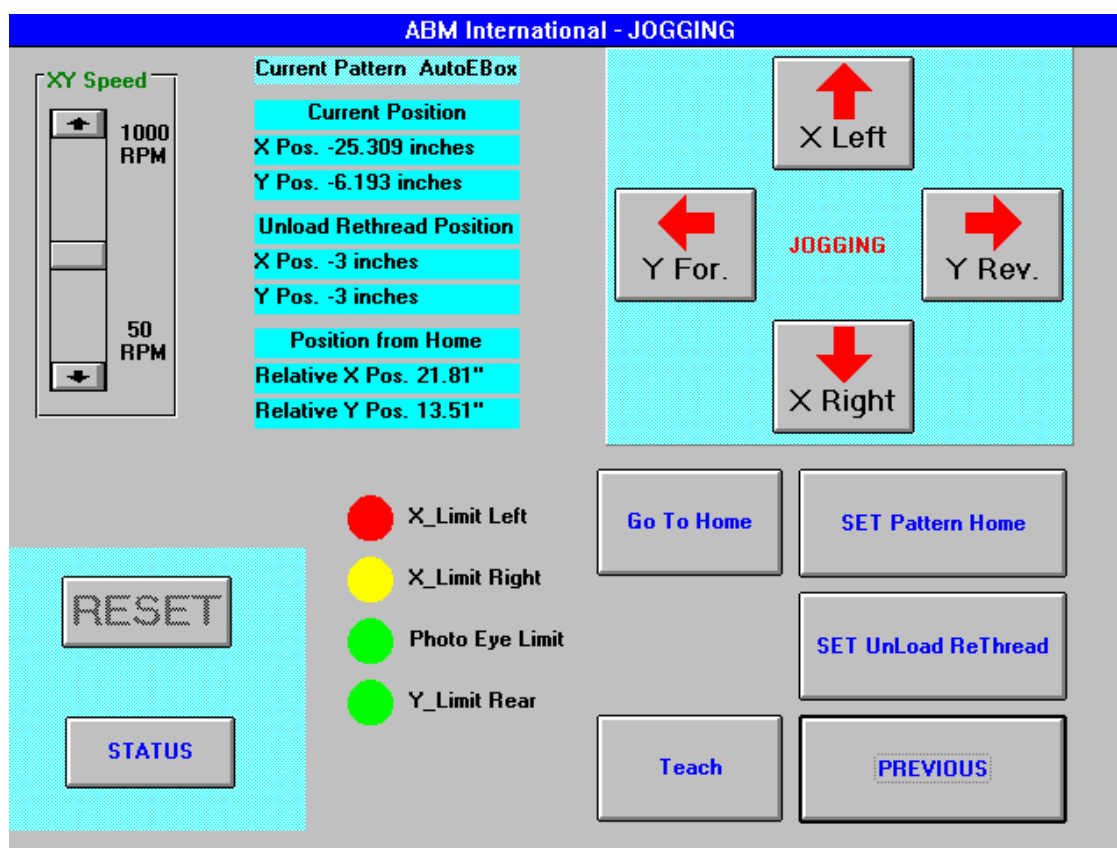
Figure 2. 5a - The Jog Screen

The box in the upper right has four Jogging buttons. These buttons allow the operator to jog the frame in the X and Y directions.

The XY Speed scroll bar can be used to adjust the jog speed. The range is from 50 to 1000 rpm.

The Current Pattern displays the name of the pattern that is being sewed.

The X and Y Current Position of the frame are shown by the X Pos and Y Pos indicators. When the frame is jogged, the new position is updated.

Unload Rethread displays the position that the frame returns to when the XL6000M is finished sewing. This position can set by jogging the frame to a desired position and selecting Set Unload Rethread button.

Position From Home displays the position of the frame in relation to the pattern home that was set by the operator. To set the pattern home, move the frame to a desired position and selecting the Set Pattern Home button. This position is stored and used as a starting to sew point for the pattern.

The Position from Home indicator and the Pattern home button only appear when the pattern selected is using Manual Mode scaling.

The Go To Home button will go to the rethread position that has been set by the unload rethread button.

2.6 **THE TEACH AND LEARN SCREEN-**To enter the teach and learn screen the Teach Button can be selected.
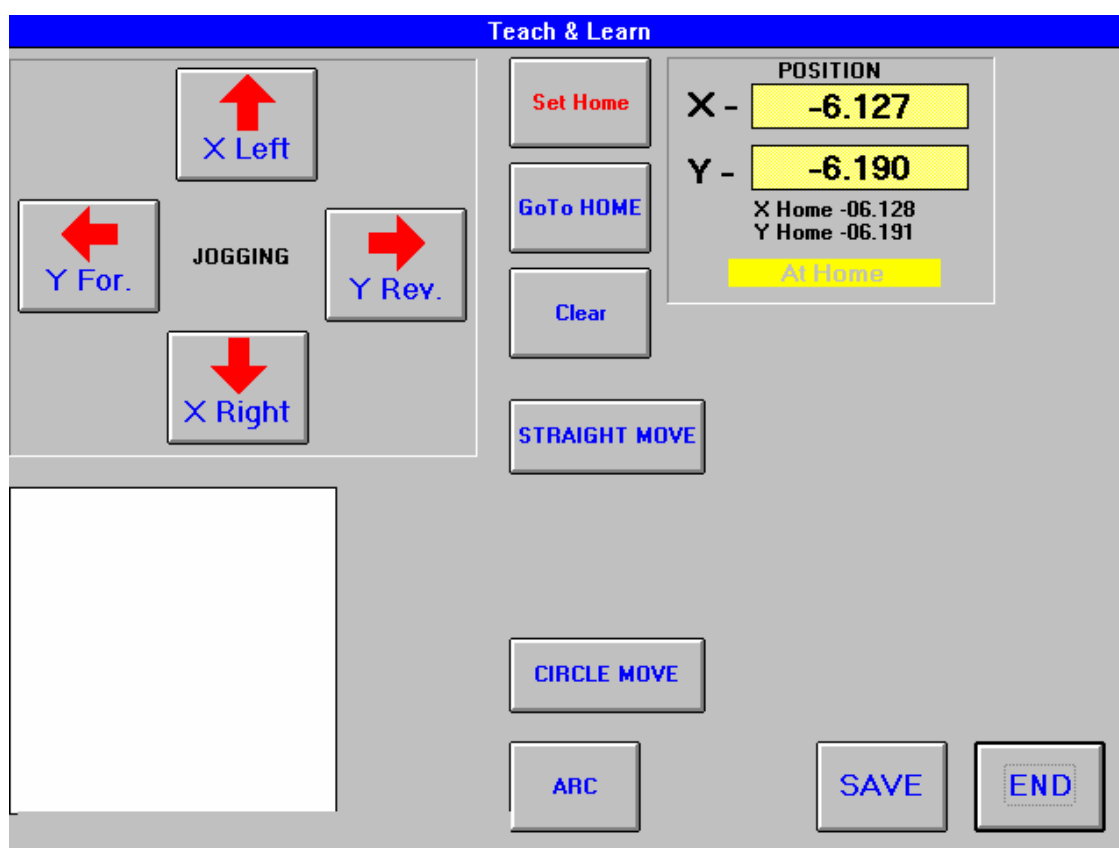
Figure 2.6a - The Teach and Learn Screen

While in the teach and learn screen, the operator attempts to simulate sewing a pattern by manually moving the frame through the pattern and recording positions.

The operator then saves the file as a new pattern that can be loaded into the XL6000M for sewing.

The preceding **(figure 2.6a)** page shows the Teach & Learn Screen.

The X and Y position is at Home and the screen is ready to accept a new Home position, or do a Straight Move, a Circle Move, or a Arc Command.

The Save button will ask for a file name, and will use the given name to create 2 files. One will be used for the pattern name and will be filed with the others in the patterns directory. The 2nd file is assigned as different file extension that will be used to save all Teach commands done up to this point in time, for this Teach session.

Developing a pattern can be a time consuming task. In order to overcome this, it is suggested that difficult parts of the pattern be saved to a separate file.

When the Arc command is first used, it will ask if you want to use a saved file.

If a pattern or Arc was created previously, it can be retrieved and used in the present pattern being developed. This can drastically reduce time when creating a pattern from scratch.

Developing a Pattern

The operator begins selecting a home or starting position for the sewing.

There are four separate jog buttons located at the top left hand corner of the screen. Start by jogging the machine to desired start of sewing position and select the **Set Home button.** This will set the start of sewing and cause the Home button to disappear from the screen.

After jogging away from this position, the operator can select the **Go to Home button.** This causes the machine to automatically position itself back to the preset home position. During the developing process it might become necessary to erase the pattern and start over. This can be accomplished by selecting the **Clear button**. Clearing the pattern will erase the pattern and cause the **Set home button** reappear.

After setting home the operator can decide whether to start the pattern with a straight line or create a circle. To create a straight line, jog the machine to the desired ending position of the line and select the **Straight Move button.**
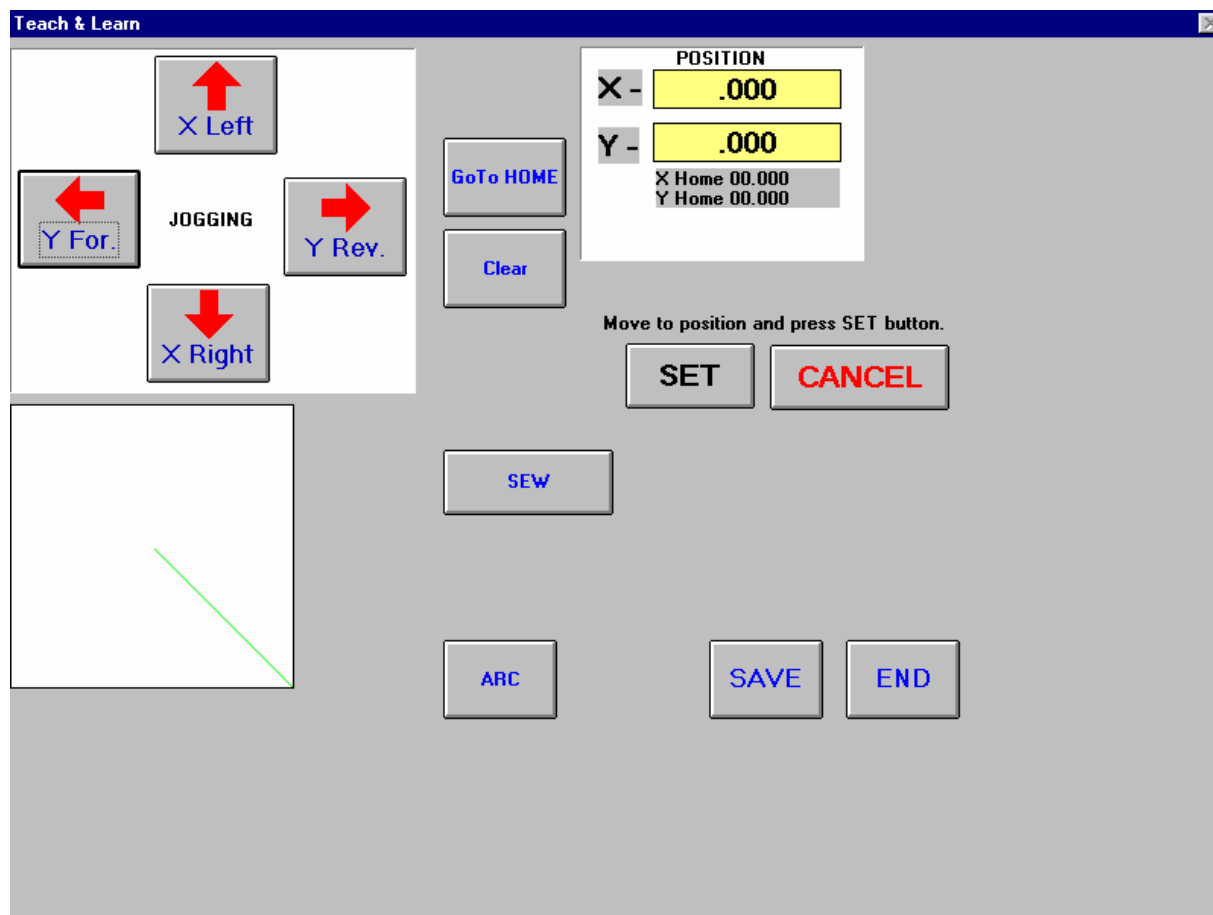
When these options appear, choose the **Set button** to record the move or the **Cancel button** remove the move.

If this line is not going to be a sewing line, click on the **Sew button** to change it to **No Sew.** This is required when jumping to different patterns with in the same area.

To use the Arc command click on the **Arc button.** A message box comes up displaying an option to retrieve an Arc from a file.

To create a more uniform pattern, an Arc can be copied into areas where the same type is needed.

If an input file is selected, another window will be displayed asking for the **Radius.**
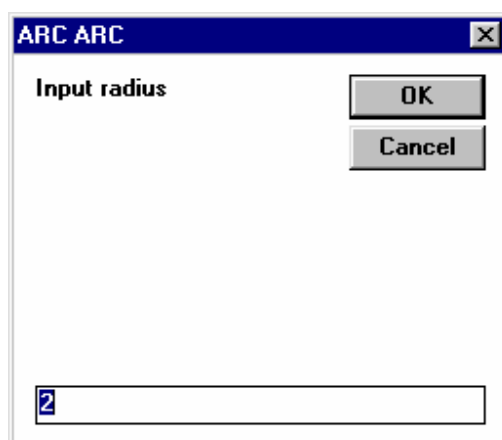
The radius is the distance perpendicular to current end point. This value can be a positive or negative number depending o the direction of the arc.

The next two windows are the degree value and direction of rotation. The degree value is in reference to the current point in a certain direction (Cw or CCw). A 90-degree rotation in a clockwise direction with a2 inch radius looks like this.
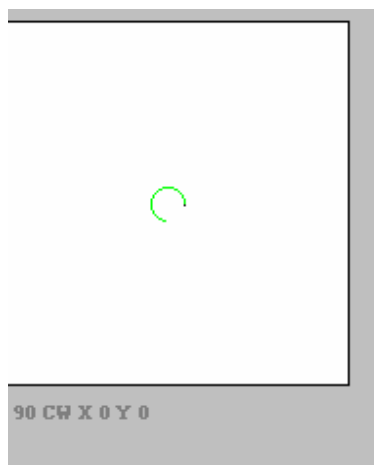
To use the **Circle button** starting from the last endpoint, move to the midpoint of the circle. Click the **Set button.** Next move to the point where the circle will end and click on set.
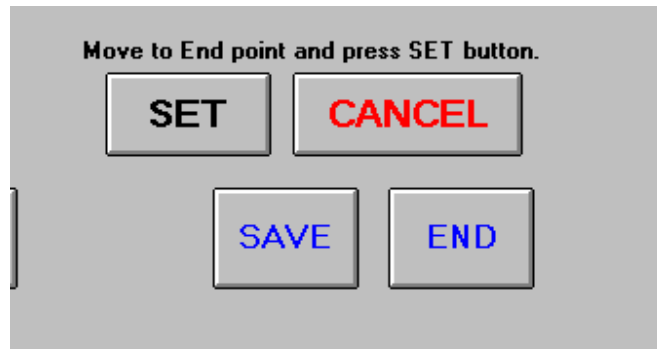
After the pattern is completed, click on the **Save button.** Give the file a name and when you enter the **Load Pattern Screen** the pattern will be available for sewing.

Click on the **End button** to return to the **Jog Screen**.

From the **Jog Screen** select the **Load Pattern button** to enter the pattern download screen.

2.7   THE LOAD PATTERN SCREEN

Patterns for sewing are selected from this screen. See **Figure 2.7a** below.
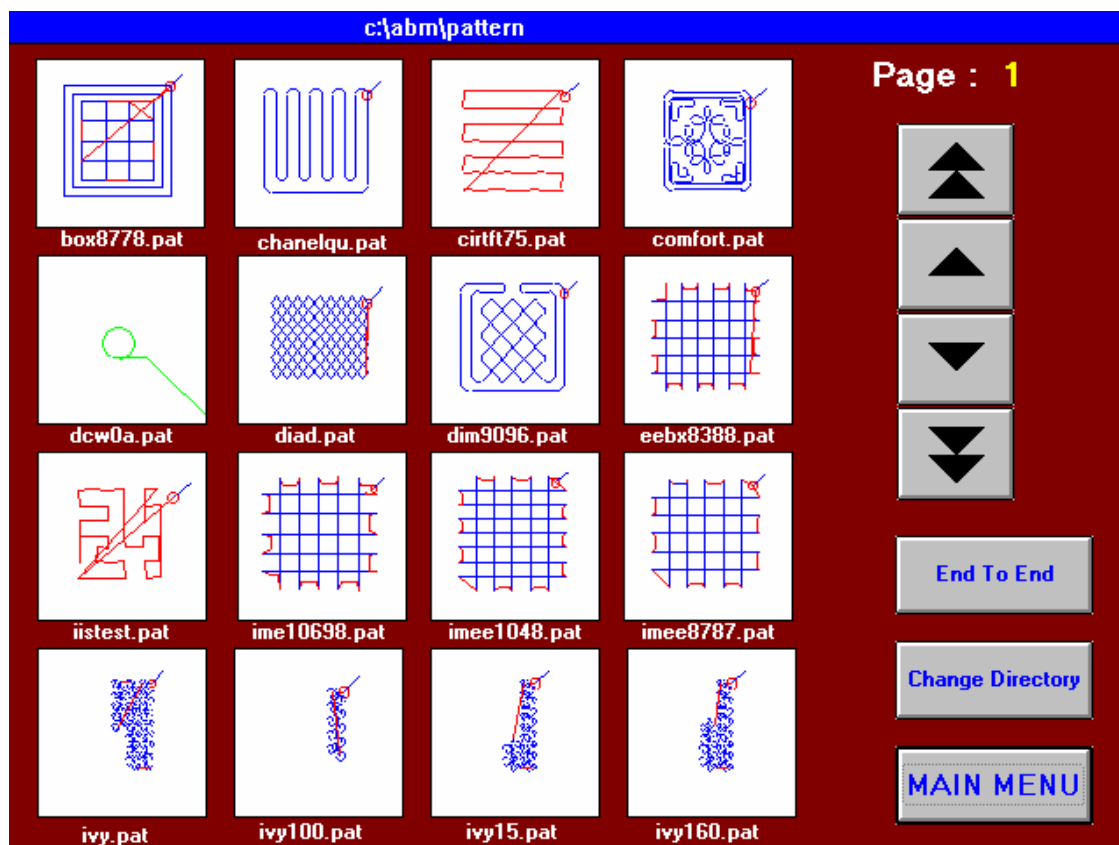
Figure 2.7a - The Load Pattern screen

From this screen up to sixteen patterns can be viewed. Other patterns if available can be selected by using the Arrow Keys.

The operator has the option of selecting a pattern by clicking on the picture displaying the pattern or choosing End To End by clicking on the End-To-End button.

When End-TO-End is selected, a pattern is automatically generated by inputting the number of X and Y lines required for that pattern.

The **Change Directory** button allows the operator to select patterns from another directory on the XL6000M System.

The **MAIN MENU** button takes you back to the OPERATION screen.

3.0 MAINTENANCE

The MAINTENANCE button can be selected from the MAIN screen. An assigned password to proceed further is required. The password procedure has two screens (see **Figures 3.1a and 3.2a**).

3.1 ENTER PASSWORD

Figure 3.1a - The First Password Screen

Selecting the Cancel button will return you to the MAIN screen.

Select the empty white box and enter your password. Selecting the OK button will validate a password. You will see a message box showing the result of the validation. If the password is not correct, you will see an "Invalid Password" message.

3.2   ALPHA-NUMERIC KEYPAD

The ALPHA-NUMERIC KEYPAD screen will appear that will allow you to enter alphanumeric keys for password entry (see **Figure 3.2a**).
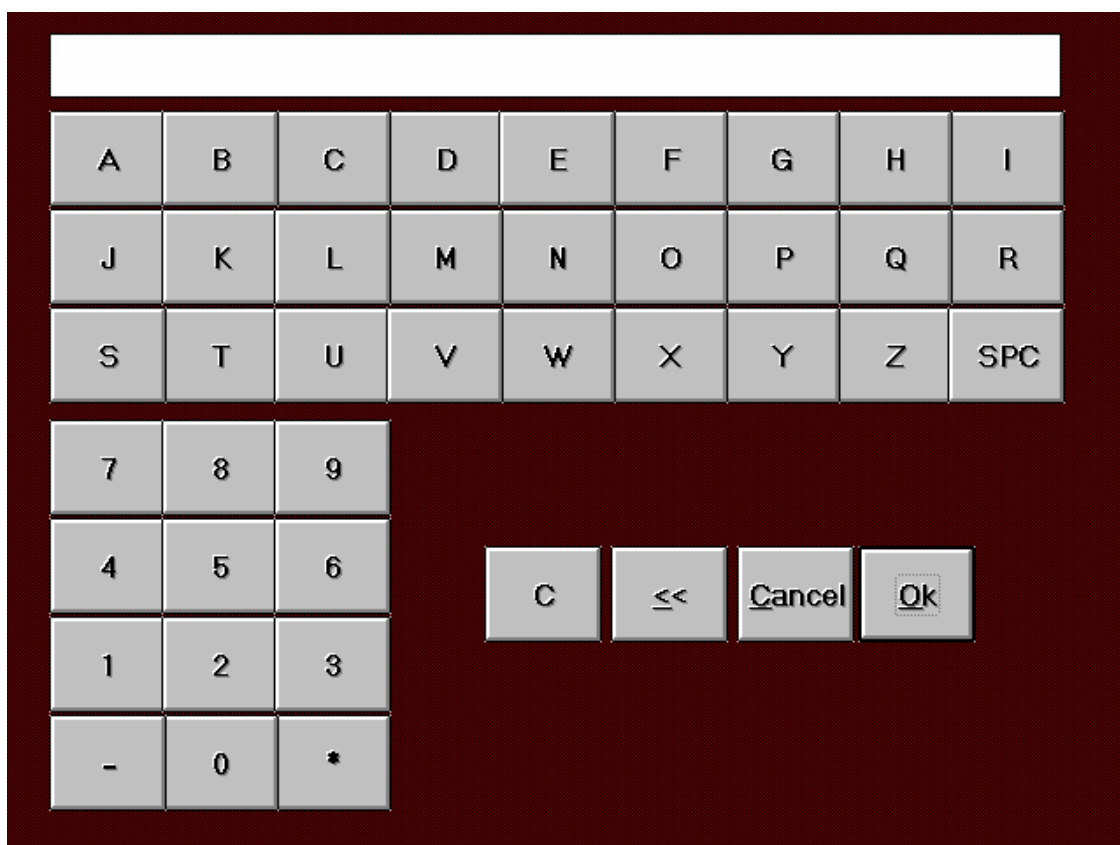
Figure 3.2a - Alpha-Numeric Keypad Screen

When this screen appears you must correctly enter the password. If you make an entry mistake, you can backspace or clear your entry. Selecting the OK button will validate your entry.

If your entry is acceptable, the PARAMETER screen (**Figure 3.3a**) will appear. If your password entry is not valid, you will get the invalid password message and you can retry and attempt to enter a correct password.

3.3 THE PARAMETER SCREEN

The PARAMETER screen allows entry of parameters and variables that both the IIS Macro-Program and the XL6000M Operating System need for proper sewing of individual comforter patterns. There can be an individual parameter list for the patterns or any pattern can use the default parameters from which custom parameters can be designed (see **Figure 3.3a**).

Figure 3.3a - The Parameter Screen

Selecting any parameter box will bring up a keypad that will allow you to enter or change the parameter setting. All of the parameters are range checked and have acceptable values. There are several that only accept a Yes or No value. The rest of the parameters have a minimum and a maximum acceptable value. The keypad will only allow entries within this range. When your parameter changes are complete, select the Save Parameter button. This will update or generate custom parameters for the sewing pattern selected.

When the **Set Defaults button** is selected, the parameters displayed will be saved as Default Parameter values. These Default values will be loaded for all selected patterns when the Save Parameters button has not been selected for the pattern.

The Parameter Screen - Continued

At any time, you can select the **Get Defaults button**. This will restore all the parameters from the Default saved values. If a parameter is changed that the IIS Macro-Program uses, new

Macro-Program elements will be generated. You will see the downloading message box when you select the **MAIN MENU button** to return to the MAIN screen.

Maximum Feedrate: Limits the fastest sewing speed. The XL6000M System will not allow a sewing speed more than this value. This is the limit of the speed bar on the OPERATION SCREEN. This entry is limited by the internal maximum value limit of the XL6000M System and is the maximum value of the limit range shown.

Feedrate: The speed in Inches/Minute of actual sewing. This is the bar position as shown in the OPERATION SCREEN. The initial Feedrate can be set here. Changing the bar position changes this value.

No Sew Feedrate: The speed in Inches/Minute of the XL6000M system when the sew head button is off.

Rapid Feedrate: The speed of the system when going HOME or when Tacking.

Stitches per Inch: The number of stitches sewn per inch of travel. This value accepts tenths of inches within the limits shown.

Lin Accel: The Linear Acceleration parameter sets the point at which slow down begins around corners.   At a setting of 100%, slow down occurs for small changes in direction. At a setting of 50%, the speed decrease begins at an angle of 45 degrees and declines linearly to a 90-degree change in direction. Everything above 90 degrees is sewn at minimum speed.

High / low Accel: If there is a pattern that has a lot of sharp turns it is recommended that this be set on low. This helps to smooth out the sewing process.

Minimum Sew Speed: The percentage of Feedrate used as the minimum sewing speed around sharp corners or reversals in sew direction.

Thread Cut Delay: The amount of delay in milli-seconds when the needle is positioned to the up position and the thread is cut.

Thread Break Delay: The amount of delay in milliseconds before faulting the system on a thread break.

The Parameter Screen - Continued

Oiler: This determines how often the sew head will be oiled during operation.

Anti Back Lash: This helps to overcome gear backlash on the X and Y-axis.

Modes-: Manual this is used when the machine is set up manually.

Auto Border: When selected, enables the Auto Border mode. This mode will produce the borders as selected by Xborder & Yborder parameters.

End-to-End: This is used when sewing patterns that only need to have the number of lines entered.

**Framed
End to End:** This is used the same as above but it has an outside border.

Offsets: These are offset to the currently selected border. They will decrease the sewing area for the pattern by the amount selected.

Frame Type: This is used in conjunction with the mode selection determining which frame will be used.

Border Gap: This allows the border vary the outside border.

Back Tack Length: The length in inches of the Back Tack.

**Number of Back
Tacks:** The number of back tacks to perform for the Back Tack.

Patterns per Bobbin: The number of patterns that can be run on a bobbin. This value is pattern dependent.

**Back Tack
Stitches per Inch:** The number of stitches per inch used in back tacking.

**Sewing Stitches
per Inch:** Determines how many sewing stitches there are in an inch.

Xborder: The Xborder element for Auto Border.

Yborder: The Yborder element for Auto Border.

3.4   THE SET UP AND TRIM SCREEN

From the PARAMETER screen the Set Up and Trim button can be selected (see **Figure 3.4a** below).
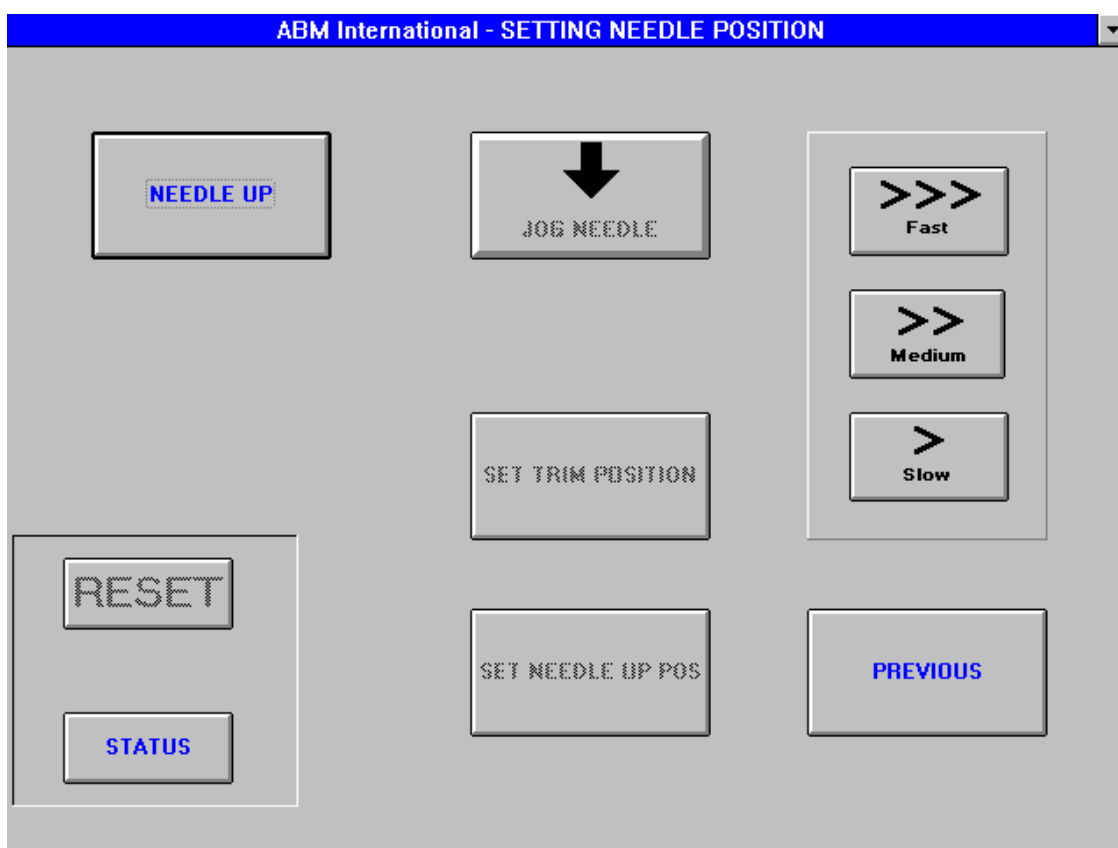
Figure 3.4a - The Set Up and Trim Screen

Selecting the **NEEDLE UP button** will enable the **JOG NEEDLE** button. The **JOG NEEDLE** button moves the needle in and out at a selected jog needle speed. When the needle is in position for trim, the **SET TRIM POSITION button** is selected. This will inform the IIS Macro-Program this is Trim needle position. The set needle up position can also be selected. The needle is again jogged for the desired position and the **SET NEEDLE UP POS button** is selected.

The three buttons Slow, Medium and Fast select the needle jog speed.

Selecting the PREVIOUS button will return you to the PARAMETER screen.

3.5   The Encoder Check Screen

Selecting the Encoder Check button from the PARAMETER screen will bring up the
ENCODER screen (see **Figure 3.5a**).
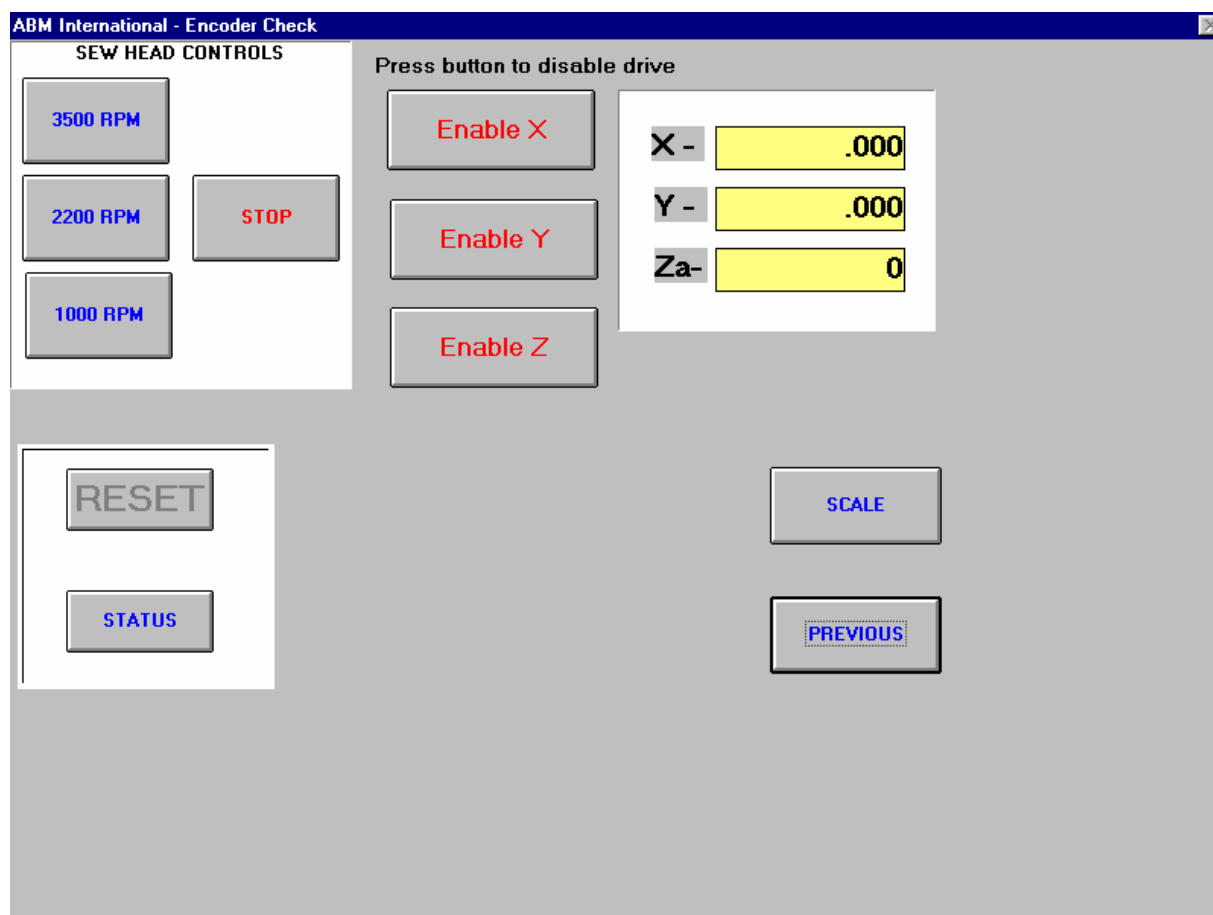
Figure 3.5a - The Encoder Screen

This example screen indicates 3 servo motor controls and 3 read out boxes.

> The Enable X button will disable/enable the X-axis servo motor. When the button is
> selected, the X-axis will be disabled and the button will read Kill X. Re-selecting the
> button will enable the X-axis servo. The X encoder position can be read in the X -
> read out box.

> The Enable Y button will disable/enable the Y-axis servo motor and functions as
> above.

The Enable Z button will disable/enable the Z-axis. The Z-axis servo controls the needle position. The Za- readout shows the sewing needle position. This button needs to be selected before any adjustments to the sewing area can be made or before removing/replacing a needle.

The SEW HEAD CONTROLS panel controls the needle speed settings. Selecting a speed will run the needle and selecting the STOP button will stop the needle. Selecting any of the speed buttons will disable the Z-axis servo. The Z-axis can be re-enabled by selecting the STOP button, then selecting the Kill Z button.

Selecting the PREVIOUS button will return the XL6000M system to the PARAMETER screen.

The SCALE button is password protected with a different password. When selected the PASSWORD screens will appear.

3.6   THE SCALE SCREEN

When the correct password has been entered, the SCALE screen will appear (see **Figure 3.6a**).
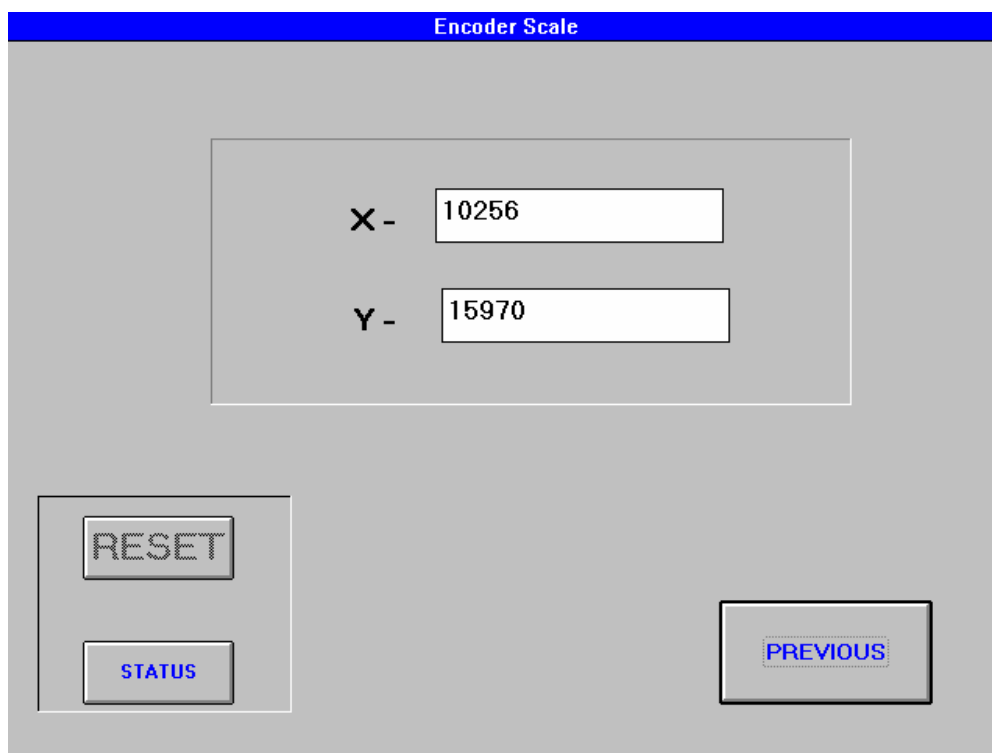
Figure 3.6a - The Scale Screen

The current X and Y-axis scale factors are shown in the readout boxes. To adjust an encoder scale, select the appropriate readout box. A keypad will appear for entry of a new scale factor. These scale factors are range checked and when an entry is selected that is out of range, the original scale factor is maintained.

The scale factor relates to the number of bits needed to travel 1 inch in the plane of travel. The encoder for the X plane is the same as the one for the Y plane but the gearing is different. Each servo has 4096 bits per revolution but to get 1 inch of travel in the X plane requires 10256 bits and to get 1 inch of travel in the y plane requires the Y servo to rotate 15970 bits.

Selecting the PREVIOUS button will return to the ENCODER screen.

3.7   THE LOAD PATTERN FROM DRIVE SCREEN

When the Load Pattern from Drive button is selected from the PARAMETERS screen (see **Figure 3.7a**) the LOAD NEW PATTERN screen will appear.
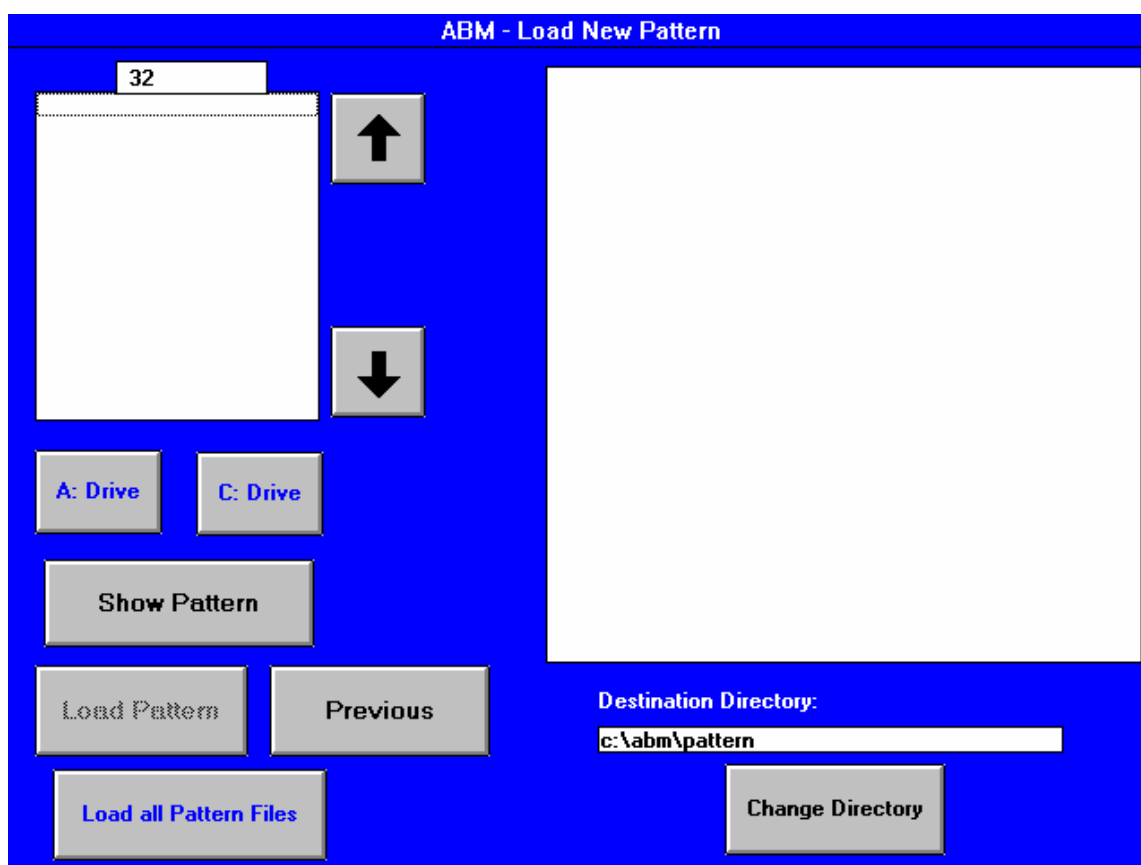
Figure 3.7a - The Load New Pattern Screen

The Load New Pattern Screen - Continued

New patterns can be entered into the XL6000M system. They can be selected from the root directory of a diskette in the A: drive or from the C:\abm\edit directory of the C: drive.

Either the A: Drive or the C: Drive button is selected. The names of the patterns from the selected drive are shown. If the selected drive has no patterns, then no names are shown. That is, if no patterns have been edited and saved, then the C:\abm\edit directory will be empty and no pattern names will be show when drive C: is selected.

To load an individual pattern, select the pattern name. The Show Pattern button is then selected and is shown in the display box. Other patterns can be selected and viewed. Select the Load Pattern button to install the pattern being viewed. The pattern will be installed in the directory & path as shown in the Destination Directory: box. (See above) This directory can be changed by selecting the Change Directory button (See **Section 3.8 & Figure 3.7b**).

The A: Drive button must be selected to use the Load all Pattern Files button. When selected, the LOADALL screen appears. Selecting the GO button will load all the patterns (see **Figure 3.7b**).

LOAD ALL PATTERNS FROM A:

GO

Box101.pat
Box102.pat
box110.pat
box112.pat

Programs to load :   0

Programs loaded :   0
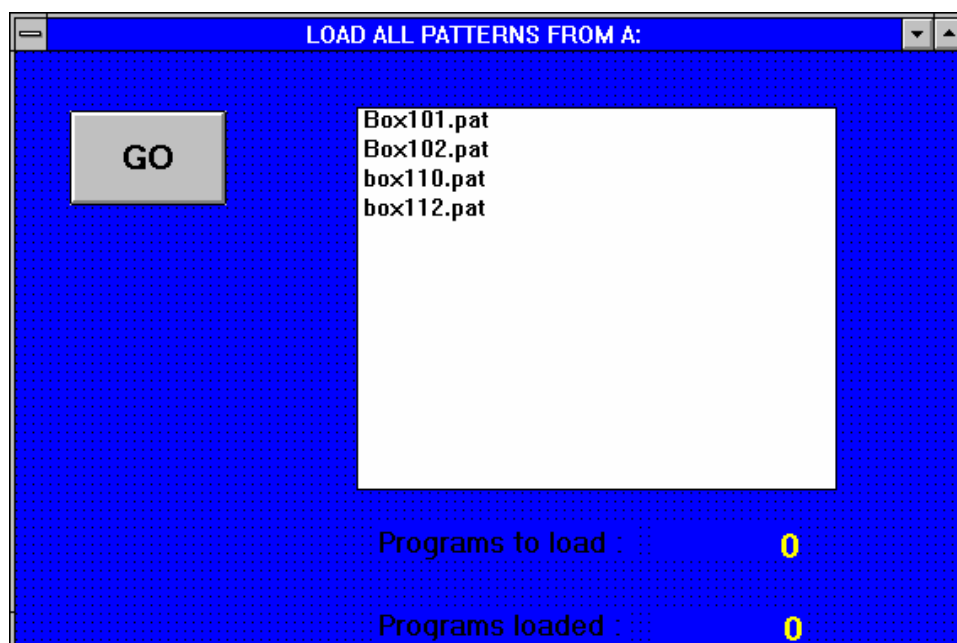
Figure 3.7b - The Load All Patterns Screen

When all of the patterns are loaded from the diskette, a message will appear indicating that the load is complete.

Selecting the Previous button from the Load New Pattern screen will return you to the PARAMETERS screen.

3.8   THE CHANGE DIRECTORY SCREEN

When the Change Directory button is selected from the LOAD NEW PATTERN screen, the Change Directory screen will appear (see **Figure 3.8a**).
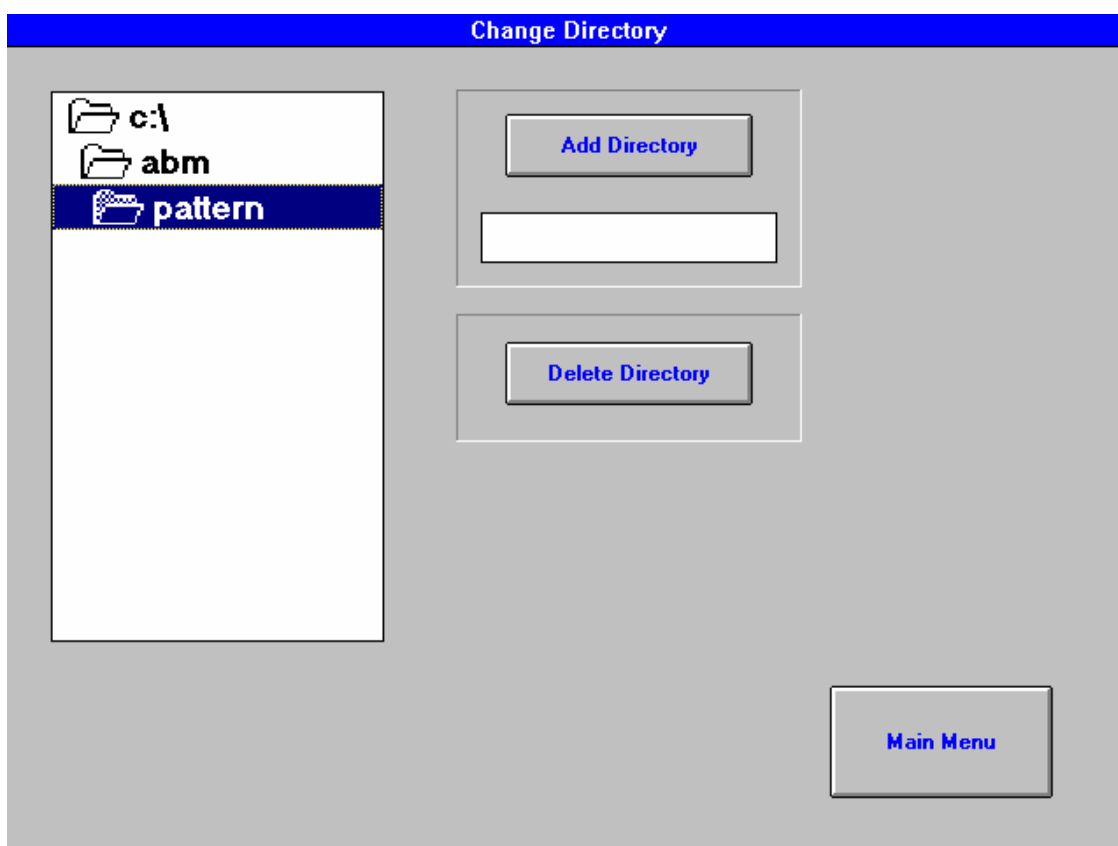
Figure 3.8a - The Change Directory Screen

The directory tree is shown with the normal default directory highlighted. The white box under the Add directory button can be selected to add sub directories under the pattern directory. When selected, a keypad will appear for entry of a sub directory name. When entered, the sub directory will be shown under the pattern directory. Sub directories can only be installed under the pattern directory. **Important: Only sub directories can be deleted by using the Delete Directory button.**

The Main Menu button will return you to the LOAD NEW PATTERN screen. If a sub directory is created and then highlighted before you return, the new Destination Directory will be shown upon return.

3.9   THE CHANGE PASSWORD SCREEN

When the Change Password button is selected from the PARAMETERS screen, the CHANGE PASSWORD screen appears (see **Figure 3.9a**).
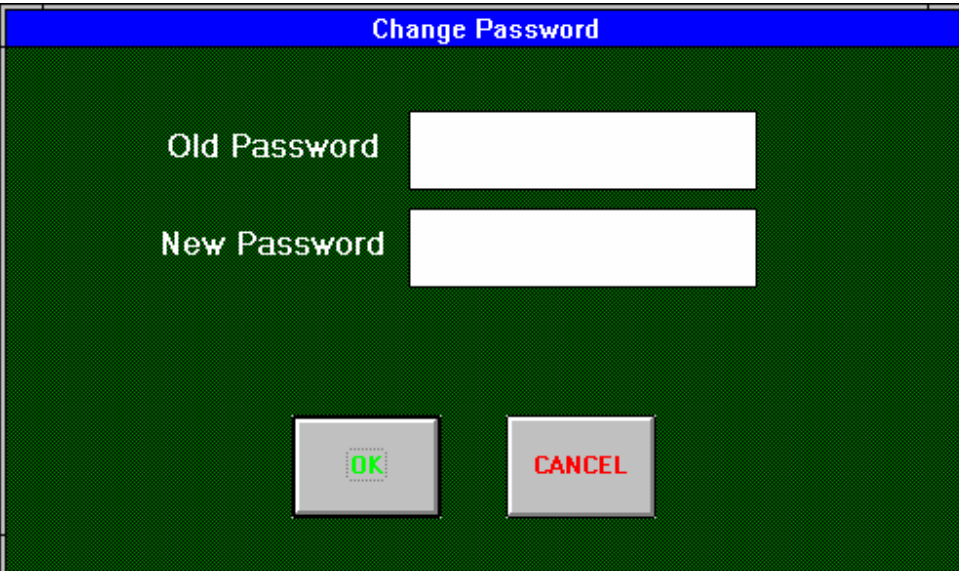
Figure 3.9a - The Change Password Screen

This screen will change the password that the XL6000M system has stored for entry into the PARAMETERS screen. **The old password must be correctly entered then the new password can be entered.**

Selecting the OK button will change the system password.

3.10   DELETING FILES

Selecting the Delete button from the PARAMETERS screen will bring up the DELETE
FILES screen (see **Figure 3.10a**).
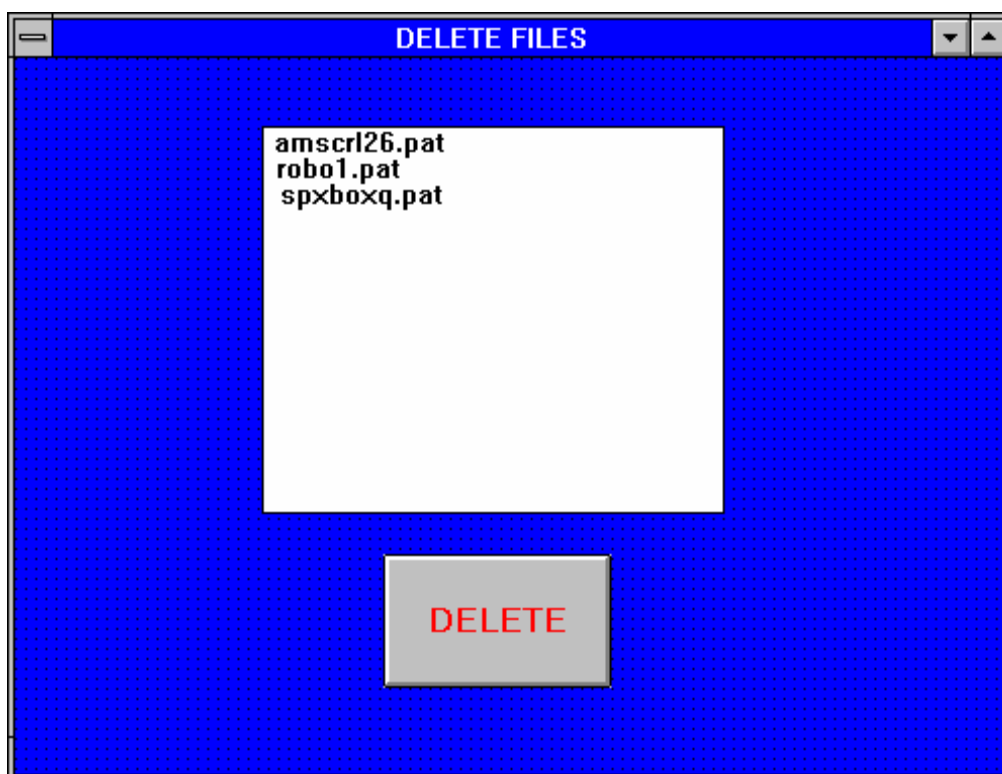
Figure 3.10a - The Delete Files Screen

From this screen you can individually select patterns for deletion. The pattern is selected,
and then the DELETE button is selected. The pattern will be deleted from the
C:\ABM\PATTERN file and will no longer be shown for pattern selection in the LOAD
PATTERN screen.

Select the Previous button to return to the PARAMETERS screen.

3.11   THE INPUT OUTPUT SCREEN

Selecting the Inputs/Outputs button from the PARAMETERS screen will bring up the INPUTS screen (see **Figure 3.11a**).
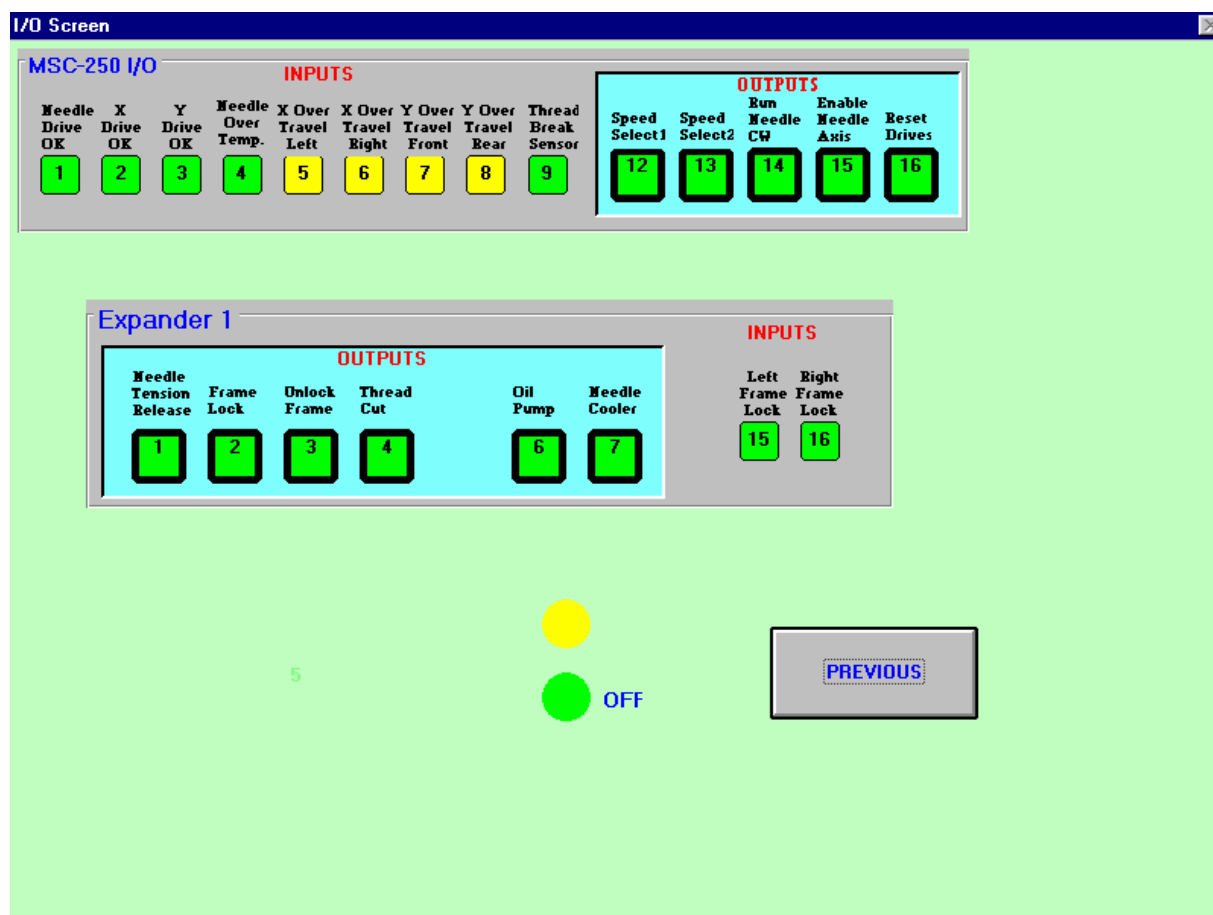
Figure 3.11a - The Input I/O Screen

This screen shows the Inputs for the XL6000M Operating System by control expander module and by expander position. It also shows the current state of the Inputs. If the input is green, it is off and if the input is yellow, it is on.

Only outputs can be toggled on and off from this screen.

I/O Definitions:

Needle Drive Ok   This input signals the MSC-250 in the case of fault in the Needle Drive.

X drive Ok   This input signals the MSC-250 in the case of a fault in the X-Axis Drive.

Y Drive Ok   This input signals the MSC-250 in the case of a fault in the Y-Axis Drive.

Needle over Temp   This input is for monitoring the temperature of the needle motor.

X Over travel Left   These inputs serve as overtravel limits that prevent the frame from crashing

X Over travel Right   into the sew head in the X-Direction.

Y Over Travel Front   These inputs serve as overtravel limits to prevent the frame from crashing into the sew head in the Y-

Y over Travel Rear   Direction

Thread Break Sensor   This is a constant pulsing input. Interruption of this signal will cause a fault condition.

Speed Sel1   These two outputs are connected to the needle drive for different speed modes

Speed Sel2

Run needle CW   This output is used to allow the MSC-250 place the needle drive in Run mode

Enable Needle Axis   This output is used to allow the MSC-250 enable and disable the needle drive.

Reset Drives   This output is used to reset all drives in the case of a drive fault condition.

Expander 1 Definitions – These are I/O that are located on the IOE-850 board.

Needle Tension	The MSC-250 controls the tension release on the sew head with this output.
Frame Lock	The MSC-250 controls the frame-lock air solenoid with this output.
Frame Unlock	The MSC-250 controls the frame –unlock solenoid with this output.
Thread Cut	This output is used to control the operation of the thread cutter solenoid.
Oil Pump	The oil pump valve solenoid is controlled by this output.
Needle Cooler	This is connected to the air solenoid that controls the cooling system for the needle.
Left Frame Lock	These inputs monitor the frame lock sensor switches. The absence of either input causes a fault.
Right Frame Lock	

3.12   THE INFO SCREEN

Selecting the INFO button will bring up the MSC INFORMATION screen (see **Figure 3.12a**).
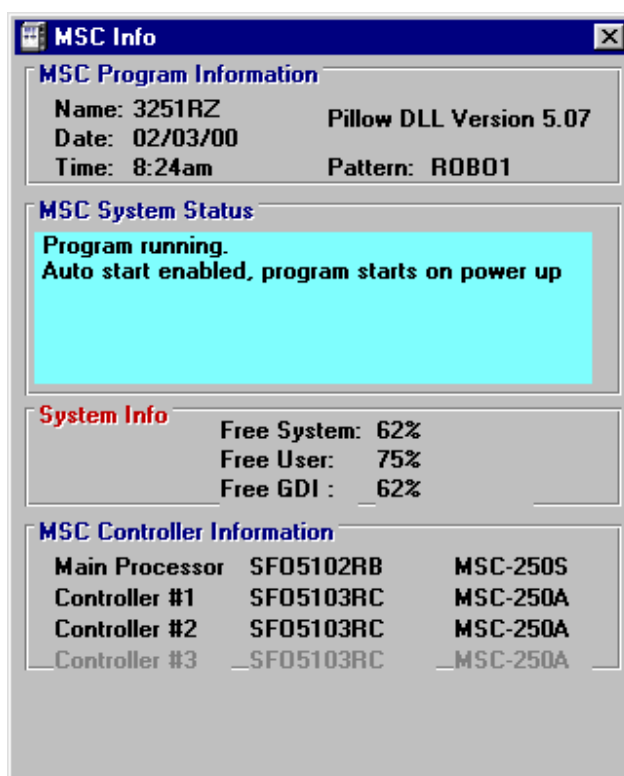
Figure 3.12a - MSC Information

This screen shows the Name, Date and Time of the Macro-Program that is currently running in the MSC.

It also shows the name of the sewing pattern last loaded to the MSC.

The MSC System Status box shows the current state of the MSC.

The MSC Controller Information lists all the controller cards installed along with the installed firmware revision.

3.13   THE DOWNLOAD SCREEN

Selecting the Download button will bring up the MACROPRO DOWNLOAD screen (see **Figure 3.13a**).
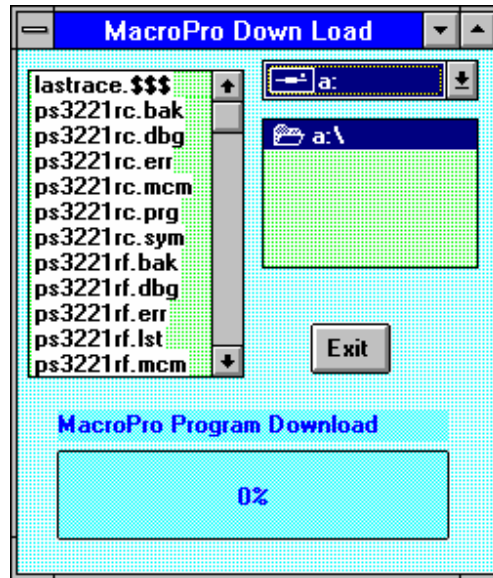
Figure 3.13a - MACROPRO Download Screen

A floppy is needed with the Macro-Program that is to be downloaded. Maintenance personnel select the proper program from the list by clicking on it and then Macro-Program code is sent to the MSC.

A progress bar will be shown along with several down load messages. When the process is complete, selecting Exit will return you to the PARAMETERS screen.

3.14   THE PROGRAM EDIT SCREEN

Selecting the Edit button from the PARAMETERS screen will bring up the PROGRAM EDIT screen (see **Figure 3.14a**).
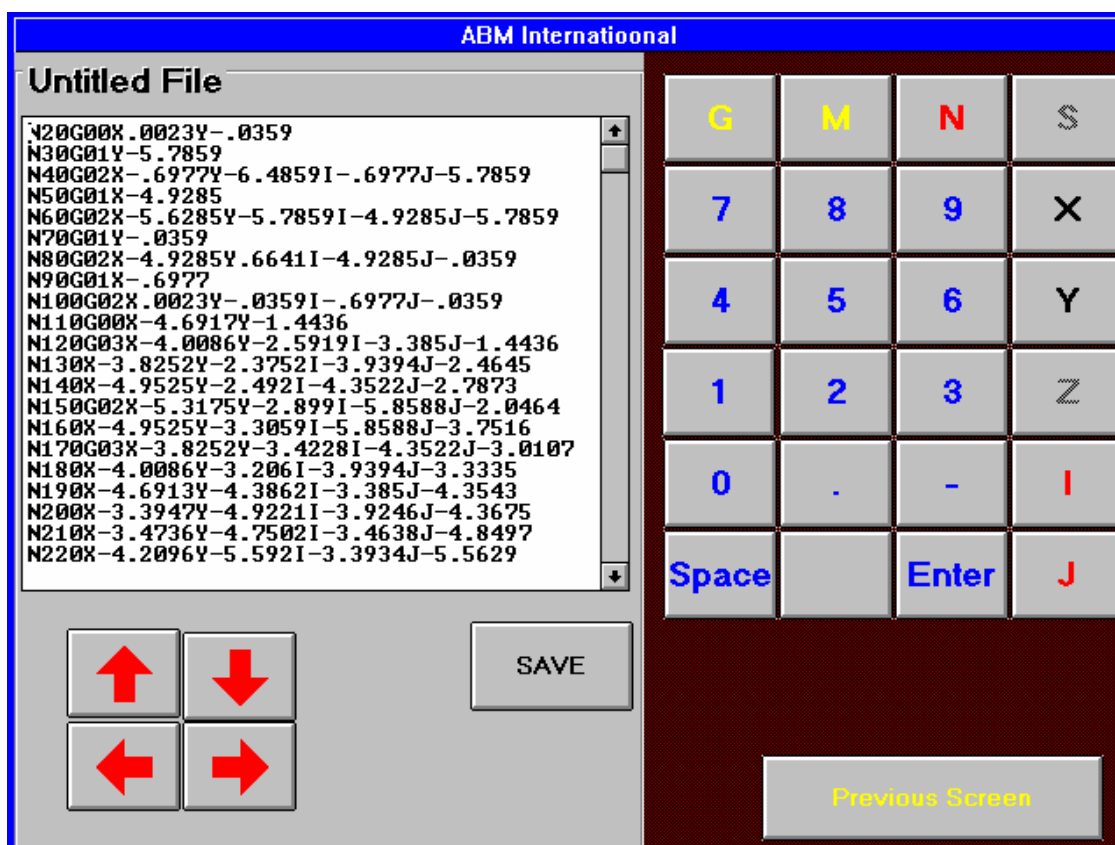
Figure 3.14a - The PROGRAM EDIT Screen

The selected patterns G codes are shown. The cursor can be positioned anywhere in the G code list. The code can be changed in any manor via the keypad. When editing is done selecting the SAVE button will save the edited file in a specific directory (C:\ABM\Edit).

Selecting the edited pattern for sewing must be done from the LOAD NEW PATTERN screen by selecting the C: Drive button and then selecting the pattern from the list of edited patterns.

Threading the Mattress Quilting Machine

Use only ABM recommended quilting thread.
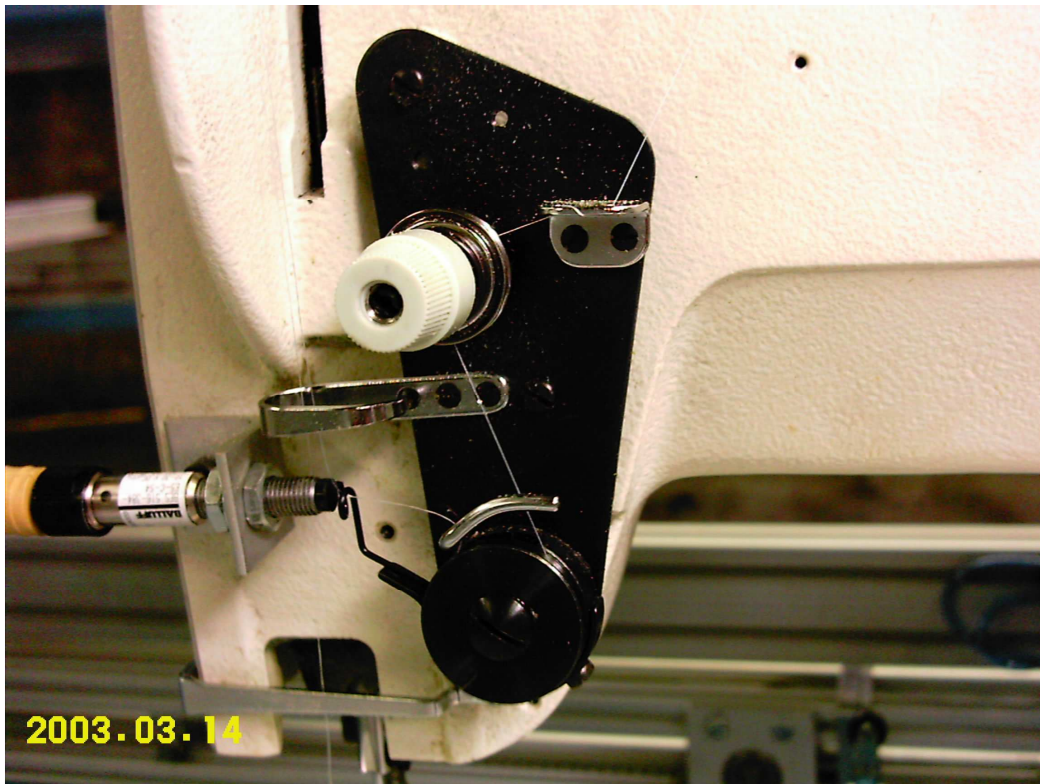
wrap black flywheel 1 ½ turns before going thru check spring.

Timing the Mattress sewing head
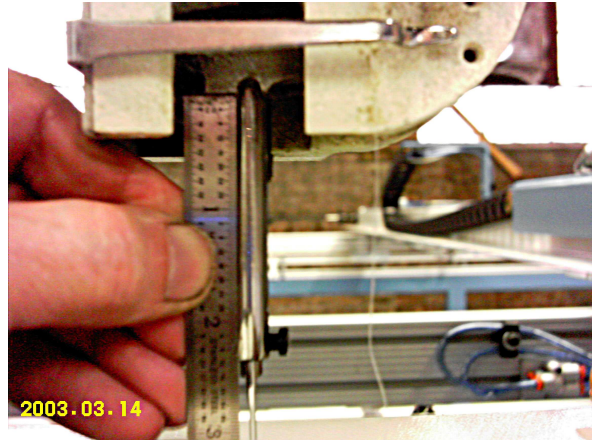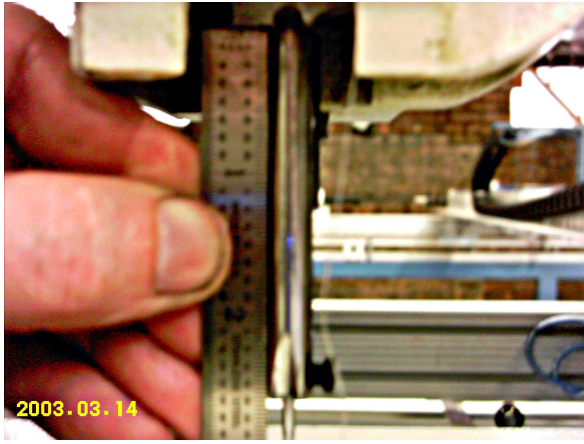
Setting the Low position | Setting the hook point

Rotate the sewing head | Raise needle bar to 2 11/32"

Handwheel (encoder check) Loosen the back coupling

Z axis off until the needle bar for the lower shaft and

Is at it's lowest position. Position the hook point in

Loosen Needle bar clamp center line of the needle.

screw and adjust The needle Lock all screws.

bar to 2 19/32"

Depending on Mattress Thickness additional settings may work better.

Factory Settings: 2 18/32   2 14/32
Bobs Settings: 2 15/32   2 12/32

面板、上板
FACE PLATE, ARM TOP COVER

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70079	*	*	*	*	1	面板	FACE PLATE
2	11570	*	*	*	*	1	面板止めねじ	THUMB SCREW 13/64X32 L=7.0
3	70080	*	*	*	*	1	面板糸掛	FACE PLATE THREAD GUIDE
4	10597	*	*	*	*	2	面板糸掛止めねじ	SCREW 1/8X40 L=3.3
5	18004	*	*	*	*	1	上板 後)	ARM CAP (REAR)
6	10704	*	*	*	*	1	上板段ねじ	SCREW 3/16X28 L=6.5
7	10703	*	*	*	*	1	上板ワッシャー	WASHER
8	18103	*	*	*	*	1	オイルタンク(後)	LUBRICATING OIL CUP (REAR)
9	7041	*	*	*	*	1	オイルタンク 後)止めねじ	SCREW 1/8X44 L=7.0
10	18104	*	*	*	*	1	オイルタンク 後)フエルト	OIL PAD
11	70181	*	*	*	*	1	油芯	OIL WICK
12	70186	*	*	*	*	1	ビニールパイプ	VINYL TUBE
13	70182	*	*	*	*	1	油芯	OIL WICK
14	70187	*	*	*	*	1	ビニールパイプ	VINYL TUBE
15	20018C	*	*	*	*	1	糸巻き糸調子 組)	BOBBIN WINDER TENSION BRACKET COMPLETE
16	150326	*	*	*	*	1	糸巻き糸調子心棒	TENSION STUD
17	20019	*	*	*	*	2	調子皿	TENSION DISC
18	20020	*	*	*	*	1	丸一皿	TENSION RELEASE DISC
19	70095	*	*	*	*	1	渦巻スプリング	TENSION SPRING
20	20021	*	*	*	*	1	糸巻き調子ローレットナット A)	TENSION THUMB NUT (A)
21	20025	*	*	*	*	1	糸巻き糸調子棒糸掛け	TENSION STUD THREAD GUIDE
22	10652	-	-	*	*	1	糸調子心棒ナット	NUT
23	70081	-	-	*	*	1	上板 前)	ARM CAP (FRONT)
24	10704	-	-	*	*	1	上板段ねじ	SCREW 3/16X28 L=6.5
25	10703	-	-	*	*	1	上板ワッシャー	WASHER
26	70082	-	-	*	*	1	オイルタンク 前)	LUBRICATING OIL CUP (FRONT)
27	70115	-	-	*	*	1	オイルタンク 前)フェルト	OIL PAD
28	70180	-	-	*	*	1	油芯	OIL WICK
29	70185	-	-	*	*	1	ビニールパイプ	VINYL TUBE
30	70111	*	*	*	*	1	糸巻糸掛け	BOBBIN WINDER THREAD GUIDE
31	8040	*	*	*	*	1	糸巻糸掛け止めねじ	SCREW 9/64X40 L=8.0
32	30025	*	*	*	*	1	ワッシャー	WASHER
33	70092	*	*	*	*	1	アーム油栓	ARM OIL PLUG
34	70116	*	-	*	-	1	針板	THROAT PLATE
34	70290	-	*	-	*	1	針板 1/4"	THROAT PLATE 1/4"
35	6031-01	-	*	-	*	1	針板止めねじ	SCREW 11/64X40 L=8.3
35	6031-01	*	-	*	-	2	針板止めねじ	SCREW 11/64X40 L=8.3
36	11162	-	*	-	*	1	針板決めねじ	SET SCREW 3.4X36 L=5.4
37	11163	-	*	-	*	1	ピン	THROAT PLATE STOP
38	70119	*	-	*	-	1	角板 左)	BED SLIDE (LEFT)
38	70218	-	*	-	*	1	角板 左)1/4"	BED SLIDE (LEFT) 1/4"
39	70120	*	-	*	-	1	角板 右)	BED SLIDE (RIGHT)
39	70224	-	*	-	*	1	角板 右)1/4"	BED SLIDE (RIGHT) 1/4"
40	10667	*	*	*	*	1	角板ピン	BED SLIDE STOP
41	10668	*	*	*	*	1	角板スプリング	BED SLIDE STOP SPRING
42	70214	-	*	-	*	1	差し板	BED SLIDE (FRONT)
43	13085	-	*	-	*	1	差し板止めねじ	SCREW 13/64X32 L=4.3
44	10794	*	*	*	*	5	玉入カップ β/8)	BALL OILER
45	30046	*	*	*	*	1	アース線止めねじ	SCREW M4X0.7 L=4.0
46	30137	*	*	*	*	2	本体支え棒(A)	MACHINE SUPPORTING BOLT
47	143657	*	*	*	*	1	糸巻き調子ラチェット	RATCHET
48	153672	*	*	*	*	1	糸巻き調子ローレットナット B)	TENSION THUMB NUT (B)

-8BL-20-1
-8BL-30-1

-28BL-20-1
-28BL-30-1

-28BL-20-1
-28BL-30-1

-8BL-20-1
-8BL-30-1

-8BL-20-1
-8BL-30-1

押え棒、中押え棒
PRESSER BAR, VIBRATING PRESSER BAR

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70027	*	–	*	–	1	針棒土台	NEEDLE BAR ROCK FRAME
1	70201	–	*	–	*	1	針棒土台	NEEDLE BAR ROCK FRAME
2	70028	*	*	*	*	1	針棒土台ピン	NEEDLE BAR ROCK FRAME HINGE STUD
3	10728	*	*	*	*	1	油芯	OIL WICK
4	70029	*	*	*	*	1	針棒土台ピン止めねじ	SCREW 6.75X24 L=19.5
5	70022	*	*	*	*	1	針棒抱き	NEEDLE BAR CONNECTION STUD
6	10726	*	*	*	*	1	油芯	OIL WICK
7	10532	*	*	*	*	2	針棒抱き締ねじ	PINCH SCREW 5/32X40 L=9.0
8	70023	*	–	*	–	1	針棒	NEEDLE BAR
8	70230	–	*	–	*	1	針棒 1/4	NEEDLE BAR 1/4
9	N3324	*	–	*	–	1	針 DYX3 #24	NEEDLE DY X 3 #24
9	N3324	–	*	–	*	2	針 DYX3 #24	NEEDLE DY X 3 #24
10	70025	*	–	*	–	1	針止めねじ	SCREW 3/16X32 L=5.5
10	70025	–	*	–	*	2	針止めねじ	SCREW 3/16X32 L=5.5
11	70030	*	*	*	*	1	イケール	NEEDLE BAR LOCK FRAME POSITION BRACKET
12	15055	*	*	*	*	1	イケール止めねじ	SCREW 1/64X32 L=9.0
13	70024	*	–	*	–	1	針棒糸掛	NEEDLE BAR THREAD GUIDE
14	10534	*	–	*	–	1	針棒糸掛止	SCREW 2.25X48 L=2.6
15	70006	*	*	*	*	1	案内棒	PRESSER BAR POSITION GUIDE
16	10761	*	*	*	*	1	案内棒止めねじ	SCREW 6.75X24 L=11.0
17	10538	*	*	*	*	1	押え棒メタル（上）	PRESSER BAR BUSHING (UPPER)
18	10761	*	*	*	*	2	押え棒メタル止めねじ	SCREW 6.75X24 L=11.0
19	70032	*	*	*	*	1	押え棒案内	PRESSER BAR POSITION GUIDE LEVER
20	10662	*	*	*	*	1	締めねじ	PINCH SCREW 5/32X40 L=6.5
21	70033	*	*	*	*	1	押え棒抱き	PRESSER BAR LIFTING BRACKET
22	10545	*	*	*	*	1	押え棒抱き締ねじ	PINCH SCREW 11/64X32 L=14.0
23	10548	*	*	*	*	1	押え棒抱き振れ止めねじ	SCREW 6.75X24 L=8.1
24	70034	*	*	*	*	1	押え棒抱きリング	PRESSER BAR SPRING BRACKET
25	70035	*	*	*	*	1	押え棒抱リング締ねじ	PINCH SCREW 3/16X32 L=13.7
26	10538	*	*	*	*	1	押え棒メタル（下）	PRESSER BAR BUSHING (LOWER)
27	70031	*	*	*	*	1	押え棒	PRESSER BAR
28	70378	*	*	*	*	1	押え金ホルダー	HOLDER
29	70114	*	–	*	–	1	外押え	LIFTING PRESSER FOOT
29	70270	–	*	–	*	1	外押え 1/4	LIFTING PRESSER FOOT 1/4
30	70379	*	*	*	*	1	押え金ホルダー止めねじ	PINCH SCREW 3.4X36 L=10.0
31	20272	*	*	*	*	1	押え金ホルダー止めねじナット	NUT
32	10677	*	*	*	*	1	ワッシャー	WASHER
33	70014	*	*	*	*	1	横軸だるま	LIFTING ECCENTRIC
34	10754	*	*	*	*	1	横軸だるま締ねじ	PINCH SCREW 6.75X24 L=16.0
35	70015	*	*	*	*	1	横軸	LIFTING ROCK SHAFT
36	10514	*	*	*	*	2	横軸メタル	LIFTING ROCK SHAFT BUSHING
37	15053	*	*	*	*	1	横軸ピンねじ	SCREW STUD
38	10728	*	*	*	*	1	油芯	OIL WICK
39	10517	*	*	*	*	1	横軸ピンねじナット	NUT
40	70038	*	*	*	*	1	くの字連結（大）	LIFTING BELL CRANK LINK
41	70036	*	*	*	*	1	くの字	LIFTING BELL CRANK
42	10559	*	*	*	*	1	くの字止めねじ	SCREW 4.5X32 L=8.0
43	70037	*	*	*	*	1	くの字連結（小）	VIBRATING PRESSER BAR CONNECTING LINK
44	70039	*	–	*	–	1	中押え棒	VIBRATING PRESSER BAR
44	70202	–	*	–	*	1	中押え棒	VIBRATING PRESSER BAR
45	10728	*	–	*	–	1	油芯	OIL WICK
46	70113	*	–	*	–	1	中押え	VIBRATING PRESSER FOOT
46	70250	–	*	–	*	1	中押え 1/4"	VIBRATING PRESSER FOOT 1/4"
47	141158	*	*	*	*	1	中押え止めねじ	SCREW 11/64X40 L=7.3
48	70219-02	*	*	*	*	1	フィンガーガード 1/4"	FINGER GUARD 1/4"
49	8111	*	*	*	*	1	フィンガーガード止めねじ	SCREW 1/8X44 L=3.6
50	70056	*	*	*	*	1	連結だるま	NEEDLE BAR ROCK FRAME CRANK
51	10754	*	*	*	*	1	連結だるま締ねじ	PINCH SCREW 6.75X24 L=16.0
52	13134	*	*	*	*	1	連結ロッド段ねじ	HINGE SCREW 6.75X24 L=12.0
53	10586	*	*	*	*	1	連結ロッド段ねじナット	NUT
54	70373	*	*	–	–	1	上送り竿	NEEDLE BAR ROCK FRAME ROCK SHAFT
54	70055	–	*	*	*	1	上送り竿	NEEDLE BAR ROCK FRAME ROCK SHAFT
55	70188	*	*	*	*	1	油パイプ	VINYL TUBE
56	11876C	*	*	*	*	1	上送り竿角玉（組）	SLIDE BLOCK COMPLETE
57	11877	*	*	*	*	1	上送り竿角玉	SLIDE BLOCK
58	11876	*	*	*	*	1	上送り竿角玉ピンねじ	SLIDE BLOCK STUD
59	10581	*	*	*	*	1	上送り竿角玉ピンねじ止めねじ	SCREW 7/32X32 L=7.0

天秤、ハンドプーリー
THREAD TAKE-UP LEVER, HAND WHEEL

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70018	*	*	*	*	1	天秤	THREAD TAKE-UP LEVER
2	70019	*	*	*	*	1	天秤ピン	THREAD TAKE-UP LEVER HINGE STUD
3	11042	*	*	*	*	1	油芯	OIL WICK
4	10571	*	*	*	*	2	天秤ピン止めねじ	SCREW 6.75X24 L=20.0
5	20172	*	*	*	*	2	アームゴム栓	CAP
6	70020	*	*	*	*	1	天秤抱き	THREAD TAKE-UP LEVER DRIVING STUD
7	10728	*	*	*	*	1	油芯	OIL WICK
8	70021	*	*	*	*	1	針棒連結	NEEDLE BAR CONNECTING LINK
9	70017	*	*	*	*	1	クランクモーションカム	NEEDLE BAR CRANK
10	10570	*	*	*	*	1	位置決めねじ	SET SCREW 6.75X24 L=14.5
11	10524-G	*	*	*	*	1	位置決めねじ止めねじ	SCREW 6.75X24 L=6.5
12	10571-G	*	*	*	*	1	止めねじ	SCREW 6.75X24 L=20.0
13	10523	*	*	*	*	1	針棒連結ピン	NEEDLE BAR CONNECTING LINK STUD
14	10726	*	*	*	*	1	油芯	OIL WICK
15	10524	*	*	*	*	1	針棒連結ピン止めねじ 長)	SCREW 6.75X24 L=6.5
16	70016	*	*	*	*	1	針棒連結ピン止めねじ 短)	SCREW 6.75X24 L=3.5
17	10563	*	*	*	*	1	上軸メタル 前)ワッシャー	WASHER
18	70007	*	*	*	*	1	上軸メタル 前)	ARM SHAFT BUSHING (FRONT)
19	10729	*	*	*	*	1	油芯	OIL WICK
20	10725	*	*	*	*	1	上軸メタル 前)フエルト	OIL PAD
21	10571	*	*	*	*	1	上軸メタル 前)止めねじ	SCREW 6.75X24 L=20.0
22	70013	*	*	*	*	1	中押え上下カム	FEED DRIVING ECCENTRIC
23	10639-G	*	*	*	*	1	中押え上下カム位置決めねじ	SET SCREW 1/4X32 L=8.0
24	10766-G	*	*	*	*	1	止めねじ	SCREW 1/4X32 L=7.0
25	70012	*	*	*	*	1	上連結ロッド	LIFTING ECCENTRIC CONNECTION
26	70112	*	*	*	*	1	糸巻ギヤー	BOBBIN WINDER DRIVING GEAR
27	10766	*	*	*	*	2	止めねじ	SCREW 1/4X32 L=7.0
28	70009	*	*	*	*	1	上軸中間メタル 前)	ARM SHAFT CENTER BUSHING (FRONT)
29	10725	*	*	*	*	1	上軸中間メタルフエルト	OIL PAD
30	10522	*	*	*	*	1	上軸中間メタル止めねじ	SCREW 6.75X24 L=14.0
31	70046	-	-	*	*	1	大ギヤー	HAND WHEEL DRIVING GEAR
32	70040	-	-	*	*	1	大ギヤー止位置決めねじ	SET SCREW 1/4X32 L=13.0
33	12388	-	-	*	*	1	大ギヤー止めねじ	SCREW 1/4X32 L=13.0
34	35405	-	-	*	*	1	小ギヤー	ARM CROSS SHAFT GEAR
35	10658	-	-	*	*	1	小ギヤー止めねじ	SCREW 1/4X32 L=5.5
36	10566	-	-	*	*	1	位置決めねじ	SET SCREW 1/4X32 L=5.5
37	10577	-	-	*	*	1	ハンドプーリー軸止めねじ	SCREW 6.75X24 L=11.0
38	70043	-	-	*	*	1	ハンドプーリー偏心メタル	ARM CROSS SHAFT BUSHING
39	10725	-	-	*	*	1	フエルト	OIL FELT
40	10519	-	-	*	*	1	ハンドプーリー偏心メタル止めねじ	SCREW 6.75X24 L=17.5
41	35412	-	-	*	*	3	クラッチスプリングピン	HAND WHEEL DISENGAGING SPRING PLUNGER
42	35413	-	-	*	*	3	クラッチスプリング	HAND WHEEL DISENGAGING SPRING
43	70041	-	-	*	*	1	ハンドプーリー	HAND WHEEL
44	35407	-	-	*	*	2	ハンドプーリースットパーねじ	SCREW 1/4X32
45	70044	-	-	*	*	1	ハンドプーリークラッチ板	HAND WHEEL ENGAGING PLATE
46	12122	-	-	*	*	4	ハンドプーリークラッチ板止めねじ	SCREW 11/64X32 L=8.5
47	70042	-	-	*	*	1	ハンドプーリー軸	ARM CROSS SHAFT
48	70010	*	*	*	*	1	上軸中間メタル 後)	ARM SHAFT CENTER BUSHING (REAR)
49	10725	*	*	*	*	1	上軸中間メタルフエルト	OIL PAD
50	10571	*	*	*	*	1	上軸中間メタル止めねじ	SCREW 6.75X24 L=14.0
51	15038	*	*	*	*	1	針棒連結ピン油栓	CAP
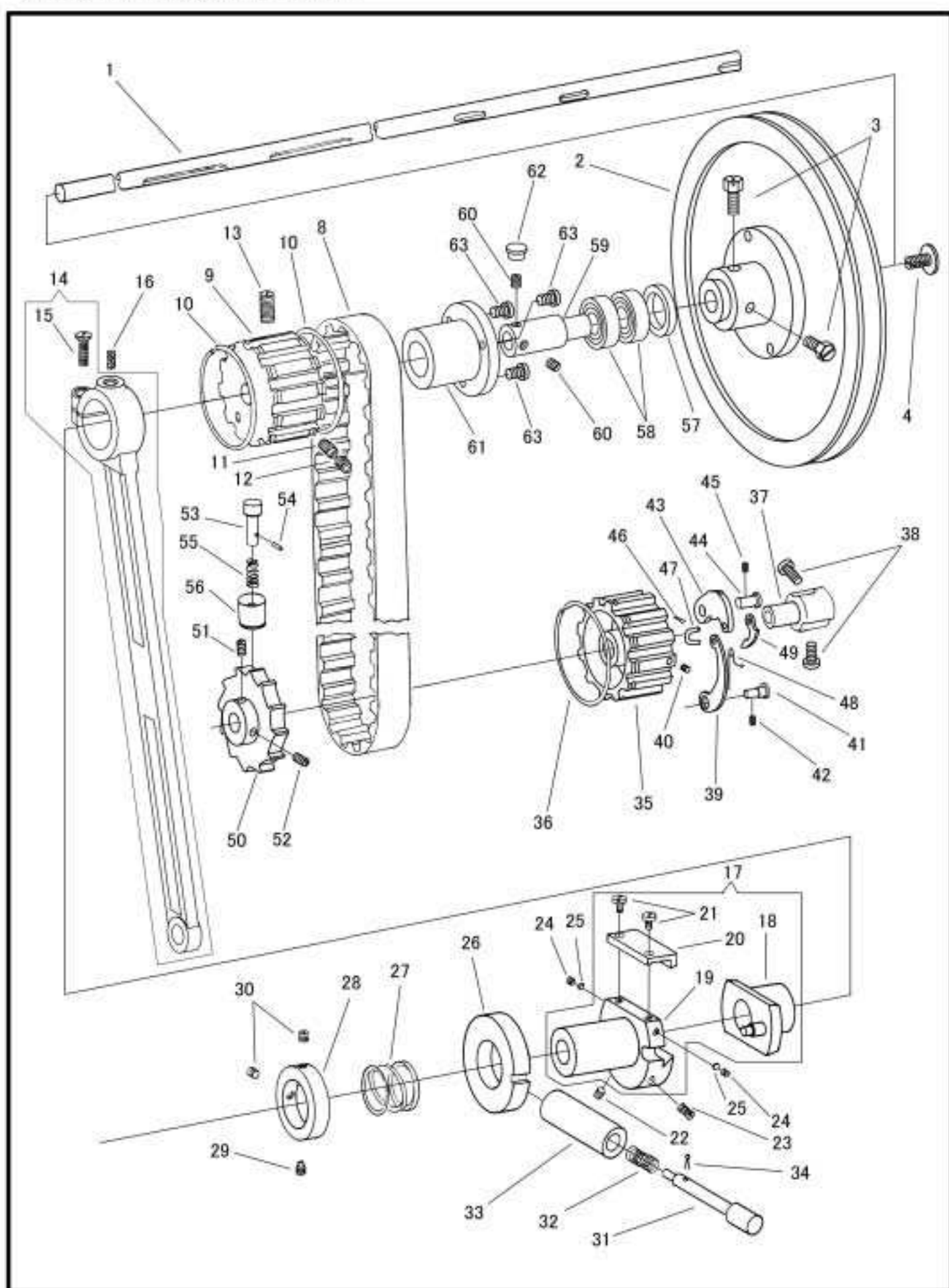
No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70008	-	-	*	*	1	上軸	ARM SHAFT
1	70372	*	*	-	-	1	上軸	ARM SHAFT
2	70093	*	*	*	*	1	プーリー	MACHINE PULLEY
3	10754	*	*	*	*	2	プーリー止めねじ	SCREW 6.75X24 L=16.0
4	10577	*	*	*	*	1	プーリー押しねじ	SCREW 6.75X24 L=11.0
8	10464-WH	*	*	*	*	1	タイミングベルト	CONNECTION BELT
9	10569	*	*	*	*	1	上ベルトプーリー	ARM SHAFT CONNECTION BELT PULLEY
10	10574	*	*	*	*	2	プーリーリング	ARM SHAFT CONNECTION BELT PULLEY SPRING FLANGE
11	10761	*	*	*	*	1	上ベルトプーリー位置決めねじ	SET SCREW 6.75X24 L=11.0
12	10524-G	*	*	*	*	1	位置決めねじ止めねじ	SCREW 6.75X24 L=6.5
13	10571-G	*	*	*	*	1	止めねじ	SCREW 6.75X24 L=20.0
14	70047	*	*	*	*	1	立ロッド	FEED DRIVING CONNECTION
16	10728	*	*	*	*	1	油芯	OIL WICK
17	70049C	*	*	*	*	1	送り土台 送りカム 組）	FEED DRIVING ECCENTRIC FLANGE COMPLETE
18	70050	*	*	*	*	1	送りカム	FEED DRIVING ECCENTRIC
19	70049	*	*	*	*	1	送りカム土台	FLANGE
20	11095	*	*	*	*	1	送りカム調節板	FRICTION PLATE
21	11096	*	*	*	*	2	送りカム調節板止めねじ	SCREW 3/16X40 L=11.0
22	11093	*	*	*	*	1	位置決めねじ	SET SCREW 3/16X32 L=10.5
23	11094	*	*	*	*	1	止めねじ	SCREW 3/16X32 L=10.5
24	2067	*	*	*	*	2	ライナー止めねじ	SCREW 11/64X40 L=6.0
25	11097	*	*	*	*	2	送りカム土台ライナー	LINING METAL
26	70051	*	*	*	*	1	渦巻カム	FEED DRIVING ECCENTRIC ADJUSTING DISC
27	11099	*	*	*	*	1	押しリングスプリング	SPRING
28	70052	*	*	*	*	1	押しリング	COLLAR
29	10639	*	*	*	*	1	位置決めねじ	SET SCREW 1/4X32 L=8.0
30	10566	*	*	*	*	2	止めねじ	SCREW 1/4X32 L=5.5
31	70054	*	*	*	*	1	押しボタン	FEED REGULATING STUD
32	12383	*	*	*	*	1	段ピンスプリング	SPRING
33	70053	*	*	*	*	1	押しボタン土台	BUSHING
34	15076	*	*	*	*	1	吊り棒止割りピン	RETAINING SPRING
35	70155	*	*	*	*	1	下ベルトプーリー	SAFETY CLUTCH PULLEY
36	10574	*	*	*	*	1	プーリーリング	SAFETY CLUTCH PULLEY SPRING FLANGE
37	10611	*	*	*	*	1	下ベルトプーリー心棒	SAFETY CLUTCH PULLEY COLLAR
38	10612	*	*	*	*	2	止めねじ	SCREW 1/4X32 L=10.5
39	70153	*	*	*	*	1	下ベルトプーリー板ばね	SAFETY CLUTCH LOCKING LEVER SPRING
40	70154	*	*	*	*	1	下ベルトプーリー調節ねじ	ADJUSTING SCREW 5/32X40 L=3.6
41	70169	*	*	*	*	1	下ベルトプーリー板ばねピン	STUD
42	10581	*	*	*	*	1	止めねじ	SCREW 7/32X32 L=7.0
43	10616	*	*	*	*	1	下ベルトプーリー掛金	SAFETY CLUTCH LOCKING LEVER
44	10613	*	*	*	*	1	下ベルトプーリー掛金ピン	STUD
45	10581	*	*	*	*	1	止めねじ	SCREW 7/32X32 L=7.0
46	10620	*	*	*	*	1	下ベルトプーリー割りピン	SAFETY CLUTCH THROW-IN LATCH PIN
47	10618	*	*	*	*	1	下ベルトプーリー小連結	CONNECTING LINK
48	10619	*	*	*	*	1	下ベルトプーリースプリング	SAFETY CLUTCH THROW-IN LATCH SPRING
49	10617	*	*	*	*	1	下ベルトプーリー小爪	SAFETY CLUTCH THROW-IN LATCH
50	70139	*	*	*	*	1	爪車	HOOK DRIVING SHAFT LOCK RATCHET
51	10639	*	*	*	*	1	位置決めねじ	SET SCREW 1/4X32 L=8.0
52	10766	*	*	*	*	1	止めねじ	SCREW 1/4X32 L=7.0
53	13046	*	*	*	*	1	押しボタン	HOOK DRIVING SHAFT LOCK STUD
54	15076	*	*	*	*	1	押しボタン割りピン	STOP
55	13047	*	*	*	*	1	押しボタンスプリング	SPRING
56	13045	*	*	*	*	1	押しボタン土台	SOCKET
57	10568	*	*	*	*	1	溝なしリング	RETAINING RING
58	10567	*	*	*	*	2	上軸ベアリング	ARM SHAFT BALL BEARING
59	70652	*	*	*	*	1	上軸ベアリングカラー	ARM SHAFT BALL BEARING ADAPTER
60	23637	*	*	*	*	2	上軸ベアリングカラー止めねじ	SCREW 1/4X28 L=7.5
61	70651	*	*	*	*	1	上軸ベアリングケース	ARM SHAFT BALL BEARING ADAPTER SLEEVE
62	20171	*	*	*	*	1	ゴム栓(Φ11)	RUBBER CAP
63	50109	*	*	*	*	3	上軸ベアリングケース止めねじ	SCREW 3/16X32 L=17.0
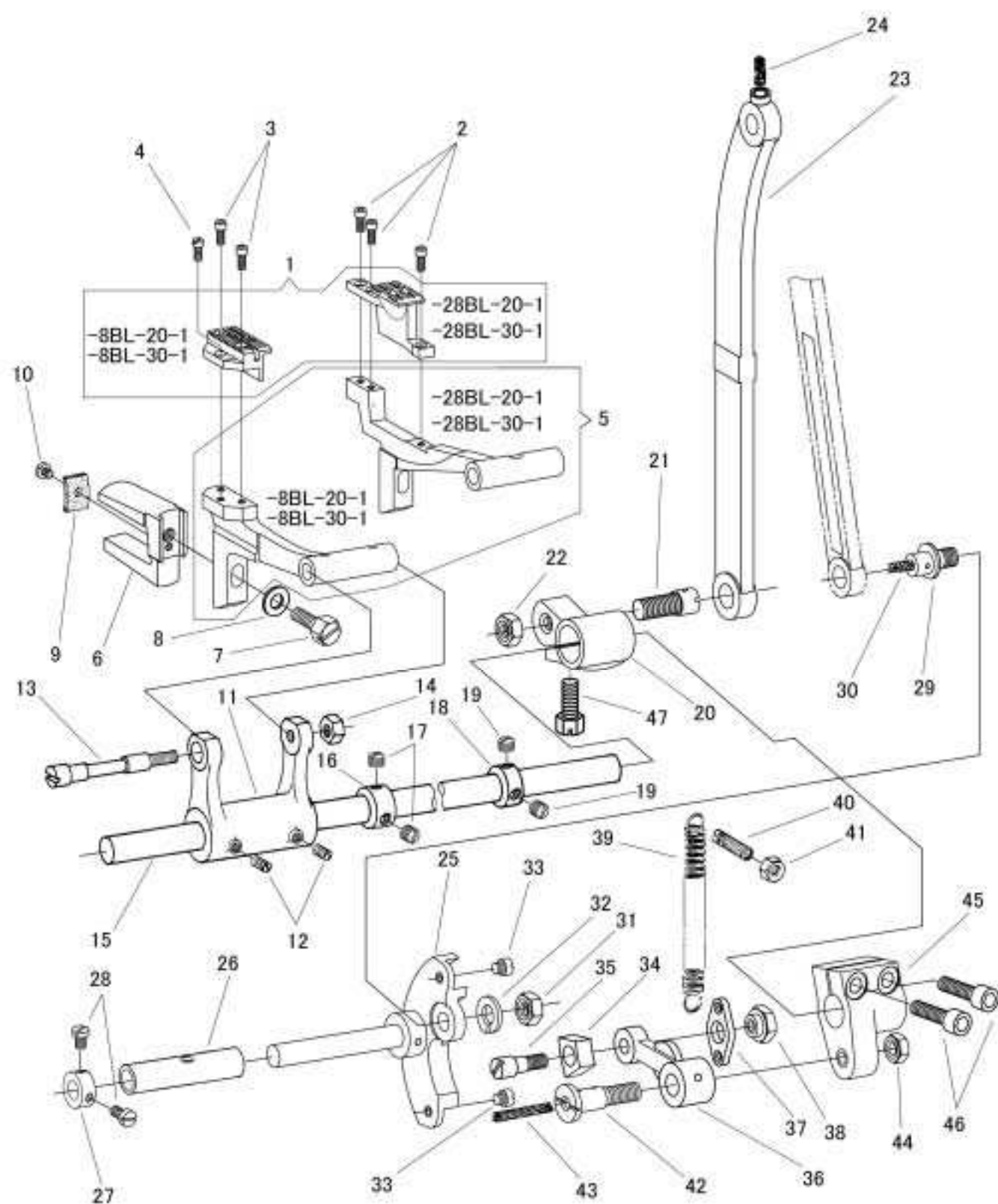
-8BL-20-1
-8BL-30-1

-28BL-20-1
-28BL-30-1

-28BL-20-1
-28BL-30-1

-8BL-20-1
-8BL-30-1

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70172	*	-	*	-	1	送り歯	FEED DOG
1	70310	-	*	-	*	1	送り歯 1/4	FEED DOG 1/4
2	70118	-	*	-	*	3	送り歯止めねじ	SCREW M3X0.5 L=8.0
3	70118	*	-	*	-	2	送り歯止めねじ	SCREW M3X0.5 L=8.0
4	23350	*	-	*	-	1	送り歯止めねじ	SCREW M3X0.5 L=7.5
5	70170	*	-	*	-	1	送り土台	FEED BAR
5	70217	-	*	-	*	1	送り土台	FEED BAR
6	70128	*	*	*	*	1	コの字	FEED LIFTING CAM FORK
7	70129	*	*	*	*	1	コの字止めねじ	SCREW 7/32X32 L=15.0
8	10599	*	*	*	*	1	コの字ワッシャー	WASHER
9	10596	*	*	*	*	1	コの字フエルト	OIL FELT
10	10597	*	*	*	*	1	コの字フエルト止めねじ	SCREW 1/8X40 L=3.3
11	70126	*	*	*	*	1	送り土台腕	FEED BAR CRANK
12	12408	*	*	*	*	2	送り土台腕止めねじ	SCREW 6.75X24 L=7.5
13	10602	*	*	*	*	1	送り土台ピンねじ	FEED BAR HINGE SCREW
14	10636	*	*	*	*	1	送り土台ピンねじナット	NUT
15	70380	*	*	-	-	1	送り軸	FEED DRIVING ROCK SHAFT
15	70608	-	-	*	*	1	送り軸	FEED DRIVING ROCK SHAFT
16	10593	*	*	*	*	1	送り軸カラー 前)	COLLAR (FRONT)
17	10764	*	*	*	*	2	送り軸カラー 前)止めねじ	SCREW 6.75X24 L=4.5
18	10593	*	*	*	*	1	送り軸カラー(後)	COLLAR (REAR)
19	10764	*	*	*	*	2	送り軸カラー 後)止めねじ	SCREW 6.75X24 L=4.5
20	70124	*	*	*	*	1	送り軸だるま 前)	FEED REVERSING CRANK (FRONT)
21	70613	*	*	*	*	1	連結ロッドピンねじ	FEED REVERSING CRANK SCREW STUD
22	11185	*	*	*	*	1	連結ロッドピンねじナット	NUT
23	70057	*	*	*	*	1	連結ロッド	NEEDLE BAR ROCK FRAME CRANK CONNECTION
24	10728	*	*	*	*	1	油芯	OIL WICK
25	70162-A	*	*	*	*	1	切り換え案内台	FEED REVERSING LEVER
26	70160	*	*	*	*	1	切り換え案内台メタル	FEED REVERSING LEVER BUSHING
27	70161	*	*	*	*	1	切り換え案内台カラー	COLLAR
28	10561	*	*	*	*	2	切り換え案内台カラー止めねじ	SCREW 11/64X32 L=6.5
29	70048-A	*	*	*	*	1	立ロッドピンねじ	HINGE SCREW 7.85X20 L=12.0
30	10728	*	*	*	*	1	油芯	OIL WICK
31	11185	*	*	*	*	1	立ロッドピンねじナット	NUT
32	20191	*	*	*	*	1	スプリングワッシャー	SPRING WASHER
33	70163	*	*	*	*	2	案内駒ストッパーねじ	SCREW 3/16X32 L=3.6
34	70612	*	*	*	*	1	切換え案内駒	FEED REVERSING LEVER SLIDE BLOCK
35	70611	*	*	*	*	1	案内駒ピンねじ	HINGE SCREW 15/64X28 L=10.0
36	70610	*	*	*	*	1	切換えクランク	FEED REVERSING LINK
37	70159	*	*	*	*	1	切換えクランクスプリング掛け	SPRING AND TREADLE CONNECTING LINK
38	70167	*	*	*	*	1	案内駒ピンねじナット	NUT
39	70158	*	*	*	*	1	切換えクランクスプリング	SPRING
40	70156	*	*	*	*	1	切換えスプリング掛ねじ	SPRING HOOK
41	70157	*	*	*	*	1	切換えスプリング掛ねじナット	NUT
42	70168	*	*	*	*	1	切換えクランク段ねじ	HINGE SCREW 7.85X20 L=21.6
43	10728	*	*	*	*	1	油芯	OIL WICK
44	11185	*	*	*	*	1	切換えクランク段ねじナット	NUT
45	70609	*	*	*	*	1	送り軸だるま 後)	FEED REVERSING CRANK (REAR)
46	35034	*	*	*	*	2	送り軸だるま 後)締めねじ	PINCH SCREW M6X1 L=20.0
47	10754	*	*	*	*	2	送り軸だるま 前)締めねじ	PINCH SCREW 6.75X24 L=16.0

-8BL-20-1
-8BL-30-1

-28BL-20-1
-28BL-30-1

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70141	*	*	*	*	1	ボビン	BOBBIN
2	70140	*	*	*	*	1	カマ 組)	HOOK COMPLETE
3	70151	*	*	*	*	1	カマ連結メガネ	BOBBIN CASE OPENER LEVER LINK
4	70145	*	*	*	*	1	カマメタル 上)	HOOK BUSHING (UPPER)
5	11176	*	*	*	*	1	カマメタル 上)止めねじ	SCREW 7/32X32 L=5.5
6	70149C	*	*	*	*	1	オープナー土台 組)	BOBBIN CASE OPENER LEVER
7	10727	*	*	*	*	1	フエルト	OIL FELT
8	70150	*	*	*	*	1	オープナー土台ピン	BOBBIN CASE OPENER LEVER HINGE STUD
9	10727	*	*	*	*	1	フエルト	OIL FELT
10	10573	*	*	*	*	1	オープナー土台ピン止めねじ	SCREW 7/32X32 L=11.0
11	11137	*	*	*	*	1	オープナー土台ピンパイプ	OIL WICK VINYL TUBE
12	70146	*	*	*	*	1	ボビンケースオープナー	BOBBIN CASE OPENER
13	70147	*	*	*	*	1	止めねじ	SCREW M3X0.5 L=6.0
14	70148	*	*	*	*	1	ワッシャー	WASHER
15	70152	*	*	*	*	1	オイルゲージ	OIL GAUGE
16	11131	*	*	*	*	1	案内パイプ	OIL GAUGE GUIDE
17	11145	*	*	*	*	1	カマ土台締付カラー 上)	HOOK SADDLE COLLAR (UPPER)
18	11146	*	*	*	*	1	カマ土台締付カラー 下)	HOOK SADDLE COLLAR (LOWER)
19	70143	*	*	*	*	1	カマ土台取付台	OIL RESERVOIR SPACER
20	70144	*	*	*	*	2	カマ土台取付台止めねじ	SCREW 7/32X32 L=21.0
21	70142	*	*	*	*	1	カマ土台 右)	HOOK SADDLE (RIGHT)
22	15092	*	*	*	*	1	カマ土台シートパッキン	HOOK SADDLE GASKET
23	15091	*	*	*	*	1	カマ土台油タンク 右)	OIL RESERVOIR (RIGHT)
24	15007	*	*	*	*	7	カマ土台油タンク止めねじ	SCREW 9/64X40 L=10.0
25	11144	*	*	*	*	1	カマ土台締ねじ	PINCH SCREW 7/32X32 L=32.0
26	10646	*	*	*	*	1	カマ土台止めねじ	SCREW 6.75X24 L=28.0
27	10647	*	*	*	*	1	カマ土台止めねじワッシャー	WASHER
28	15093	*	*	*	*	1	油調節ダイヤル	OIL REGULATING DIAL
29	15094	*	*	*	*	1	Oリング	O-RING
30	10629	*	*	*	*	1	油調節ダイヤル止めねじ	SCREW 1/8X40 L=8.0
31	10638	*	*	*	*	1	大ギヤー	HOOK DRIVING GEAR
32	70137	*	*	*	*	1	位置決めねじ	SET SCREW 1/4X32 L=9.0
33	70138	*	*	*	*	1	止めねじ	SCREW 1/4X32 L=8.0
34	10657	*	*	*	*	1	小ギヤー	HOOK DRIVING PINION
35	10658	*	*	*	*	1	小ギヤー止めねじ A)	SCREW 1/4X32 L=5.5
36	10767	*	*	*	*	1	小ギヤー止めねじ B)	SCREW 1/4X32 L=4.5
37	15096	*	*	*	*	1	カマメタル 下)	HOOK BUSHING (LOWER)
38	11176	*	*	*	*	1	カマメタル 下)止めねじ	SCREW 7/32X32 L=5.5
39	10644	*	*	*	*	1	カマメタル 下)ワッシャー	WASHER
40	10637	*	*	*	*	1	上下送りカム ねじ付)	FEED LIFTING CAM COMPLETE
41	10658	*	*	*	*	1	上下送りカム止めねじ	SCREW 1/4X32 L=5.5
42	12135	*	-	*	-	1	下軸メタル 前)	HOOK DRIVING SHAFT BUSHING (FRONT)
42	70132	-	*	-	*	1	下軸メタル 前) 1/16〜1/4	HOOK DRIVING SHAFT BUSHING (FRONT) 1/16〜1/4
42	70132-A	-	*	-	*	1	下軸メタル 前) 5/16〜1-1/8	HOOK DRIVING SHAFT BUSHING (FRONT) 5/16〜1-1/8
42	70132-B	-	*	-	*	1	下軸メタル 前) 1-3/16〜	HOOK DRIVING SHAFT BUSHING (FRONT) 1-3/16〜
43	10729	*	*	*	*	1	油芯	OIL WICK
44	10571	*	*	*	*	1	下軸メタル止めねじ	SCREW 6.75X24 L=11.0
45	70132	*	*	*	*	1	下軸中間メタル 前) 1/16〜9/16	HOOK DRIVING SHAFT BUSHING (MIDDLE, FRONT) 1/16〜9/16
45	70132-A	-	*	-	*	1	下軸中間メタル 前) 5/8〜1-1/2	HOOK DRIVING SHAFT BUSHING (MIDDLE, FRONT) 5/8〜1-1/2
45	70132-B	-	*	-	*	1	下軸中間メタル 前) 1-9/16〜	HOOK DRIVING SHAFT BUSHING (MIDDLE, FRONT) 1-9/16〜
46	10729	*	*	*	*	1	油芯	OIL WICK
47	10519	*	*	*	*	1	下軸中間メタル 前)止めねじ	PINCH SCREW 6.75X24 L=17.5
48	70660	*	*	-	-	1	下軸	HOOK DRIVING SHAFT
48	70655	-	-	*	*	1	下軸	HOOK DRIVING SHAFT
49	70134	*	*	*	*	1	下軸中間メタル 後)	HOOK DRIVING SHAFT BUSHING (MIDDLE, REAR)
50	10766	*	*	*	*	1	下軸中間メタル 後)止めねじ	SCREW1/4X32 L=7.0
51	10593	*	*	*	*	1	下軸カラー	HOOK DRIVING SHAFT COLLAR
52	10764	*	*	*	*	2	下軸カラー止めねじ	SCREW 6.75X24 L=4.5
54	70136	*	*	*	*	1	下軸メタル 後)止めねじ	SCREW 6.75X24 L=13.0
56	70140-01	*	*	*	*	1	外かま	HOOK
57	70140-02	*	*	*	*	1	内かま	BOBBIN CASE
58	70140-3A	*	*	*	*	1	内かま押え A	HOOK GIB (A)
59	70140-3B	*	*	*	*	1	内かま押え B	HOOK GIB (B)
60	16407-04	*	*	*	*	4	内かま押え止めねじ	SCREW
61	70104-05	*	*	*	*	1	針受板	NEEDLE GUARD
62	70140-06	*	*	*	*	2	針受板止めねじ	SCREW
63	70140-10	*	*	*	*	1	糸調子バネ	BOBBIN CASE TENSION SPRING
64	70140-11	*	*	*	*	1	糸調子バネ止めねじ	SCREW
65	70140-12	*	*	*	*	1	糸調子バネ調節ねじ	BOBBIN CASE TENSION REGULATING SCREW
66	70140-19	*	*	*	*	1	フエルト	FELT
67	30157	*	*	*	*	1	下軸ベアリングケース	HOOK DRIVING SHAFT BALL BEARING ADAPTER SLEEVE
68	10609	*	*	*	*	3	溝付きリング止めねじ	SCREW 3.4X36 L=5.0
69	10607	*	*	*	*	1	下軸ベアリングカラー	HOOK DRIVING SHAFT BALL BEARING ADAPTER
70	10658	*	*	*	*	1	位置決めねじ	SCREW 1/4X32 L=5.5
71	10566	*	*	*	*	1	止めねじ	SCREW 1/4X32 L=5.5
72	10567	*	*	*	*	1	下軸ベアリング	HOOK DRIVING SHAFT BALL BEARING
73	10608	*	*	*	*	1	溝付きリング	GROOVED RETAINING RING
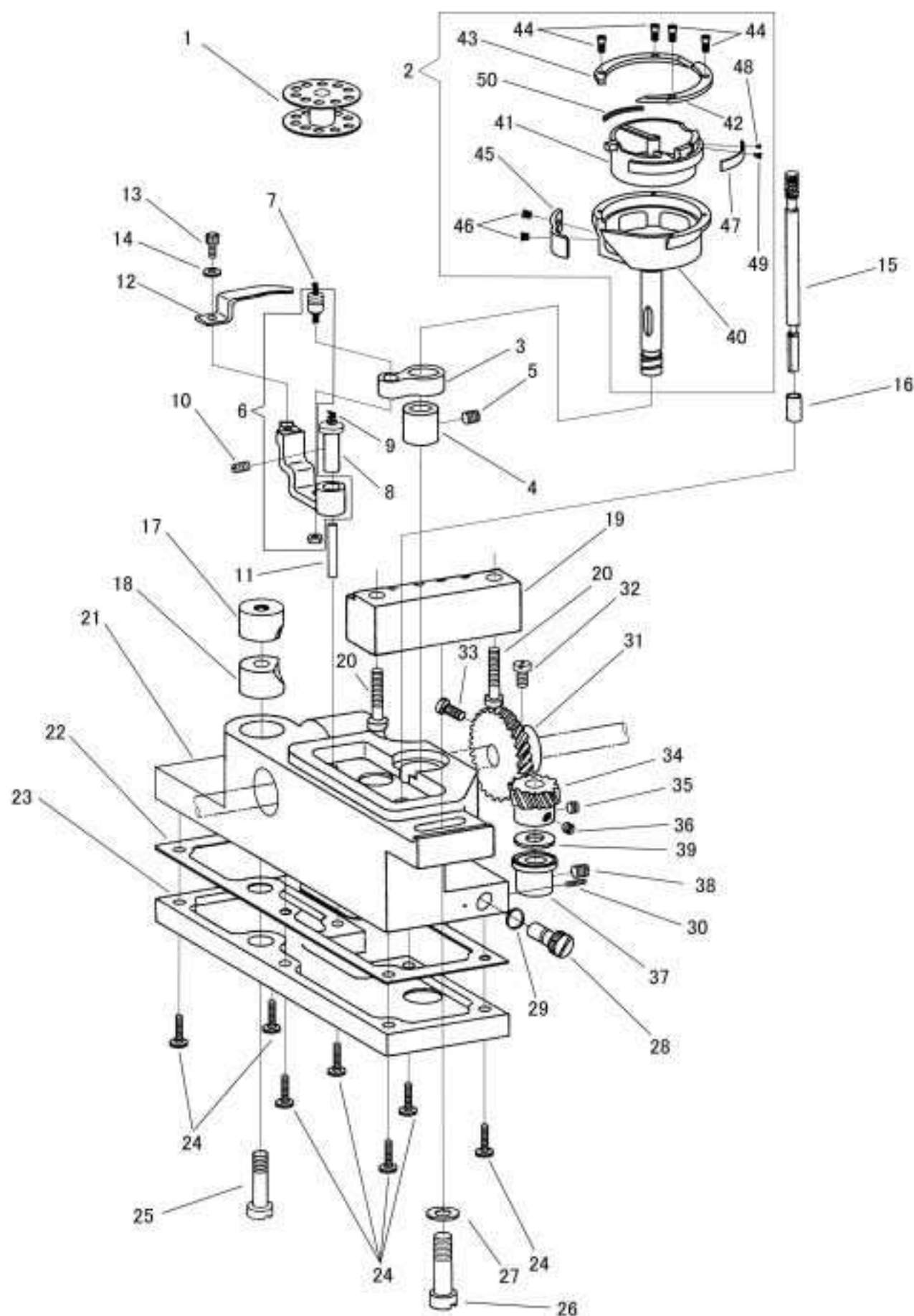
カマ土台 左）
HOOK SADDLE (LEFT)

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70141	-	*	-	*	1	ボビン	BOBBIN
2	70140	-	*	-	*	1	カマ 組）	HOOK COMPLETE
3	70151	-	*	-	*	1	カマ連結メガネ	BOBBIN CASE OPENER LEVER LINK
4	70145	-	*	-	*	1	カマメタル （上）	HOOK BUSHING (UPPER)
5	11176	-	*	-	*	1	カマメタル （上）止めねじ	SCREW 7/32X32 L=5.5
6	70149C	-	*	-	*	1	オープナー土台 組）	BOBBIN CASE OPENER LEVER
7	10727	-	*	-	*	1	フエルト	OIL FELT
8	70150	-	*	-	*	1	オープナー土台ピン	BOBBIN CASE OPENER LEVER HINGE STUD
9	10727	-	*	-	*	1	フエルト	OIL FELT
10	10573	-	*	-	*	1	オープナー土台ピン止めねじ	SCREW 7/32X32 L=11.0
11	11137	-	*	-	*	1	オープナー土台ピンパイプ	OIL WICK VINYL TUBE
12	70146	-	*	-	*	1	ボビンケースオープナー	BOBBIN CASE OPENER
13	70147	-	*	-	*	1	止めねじ	SCREW M3X0.5 L=6.0
14	70148	-	*	-	*	1	ワッシャー	WASHER
15	70152	-	*	-	*	1	オイルゲージ	OIL GAUGE
16	11131	-	*	-	*	1	案内パイプ	OIL GAUGE GUIDE
17	11145	-	*	-	*	1	カマ土台締付カラー （上）	HOOK SADDLE COLLAR (UPPER)
18	11146	-	*	-	*	1	カマ土台締付カラー （下）	HOOK SADDLE COLLAR (LOWER)
19	70143	-	*	-	*	1	カマ土台取付台	OIL RESERVOIR SPACER
20	70144	-	*	-	*	2	カマ土台取付台止めねじ	SCREW 7/32X32 L=21.0
21	70203	-	*	-	*	1	カマ土台 左）	HOOK SADDLE (LEFT)
22	15092	-	*	-	*	1	カマ土台シートパッキン	HOOK SADDLE GASKET
23	15521	-	*	-	*	1	カマ土台油タンク 左）	OIL RESERVOIR (LEFT)
24	15007	-	*	-	*	7	カマ土台油タンク止めねじ	SCREW 9/64X40 L=10.0
25	11144	-	*	-	*	1	カマ土台締ねじ	PINCH SCREW 7/32X32 L=32.0
26	10646	-	*	-	*	1	カマ土台止めねじ	SCREW 6.75X24 L=28.0
27	10647	-	*	-	*	1	カマ土台止めねじワッシャー	WASHER
28	15093	-	*	-	*	1	油調節ダイヤル	OIL REGULATING DIAL
29	15094	-	*	-	*	1	Oリング	O-RING
30	10629	-	*	-	*	1	油調節ダイヤル止めねじ	SCREW 1/8X40 L=8.0
31	10638	-	*	-	*	1	大ギヤー	HOOK DRIVING GEAR
32	70137	-	*	-	*	1	位置決めねじ	SET SCREW 1/4X32 L=9.0
33	70138	-	*	-	*	1	止めねじ	SCREW 1/4X32 L=8.0
34	10657	-	*	-	*	1	小ギヤー	HOOK DRIVING PINION
35	10658	-	*	-	*	1	小ギヤー止めねじ A）	SCREW 1/4X32 L=5.5
36	10767	-	*	-	*	1	小ギヤー止めねじ B）	SCREW 1/4X32 L=4.5
37	15096	-	*	-	*	1	カマメタル （下）	HOOK BUSHING (LOWER)
38	11176	-	*	-	*	1	カマメタル （下）止めねじ	SCREW 7/32X32 L=5.5
39	10644	-	*	-	*	1	カマメタル （下）ワッシャー	WASHER
40	70140-01	*	*	*	*	1	外かま	HOOK
41	70140-02	*	*	*	*	1	内かま	BOBBIN CASE
42	70140-3A	*	*	*	*	1	内かま押え A	HOOK GIB (A)
43	70140-3B	*	*	*	*	1	内かま押え B	HOOK GIB (B)
44	16407-04	*	*	*	*	4	内かま押え止めねじ	SCREW
45	70104-05	*	*	*	*	1	針受板	NEEDLE GUARD
46	70140-06	*	*	*	*	2	針受板止めねじ	SCREW
47	70140-10	*	*	*	*	1	糸調子バネ	BOBBIN CASE TENSION SPRING
48	70140-11	*	*	*	*	1	糸調子バネ止めねじ	SCREW
49	70140-12	*	*	*	*	1	糸調子バネ調節ねじ	BOBBIN CASE TENSION REGULATING SCREW
50	70140-19	*	*	*	*	1	フエルト	FELT

調子板
TENSION BRACKET

-8BL-20-1
-8BL-30-1

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-8BL-20-1
-8BL-30-1

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-28BL-20-1
-28BL-30-1

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-28BL-20-1
-28BL-30-1

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-28BL-20-1
-28BL-30-1

-8BL-20-1
-8BL-30-1

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-28BL-20-1
-28BL-30-1

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-8BL-20-1
-8BL-30-1

-28BL-20-1
-28BL-30-1

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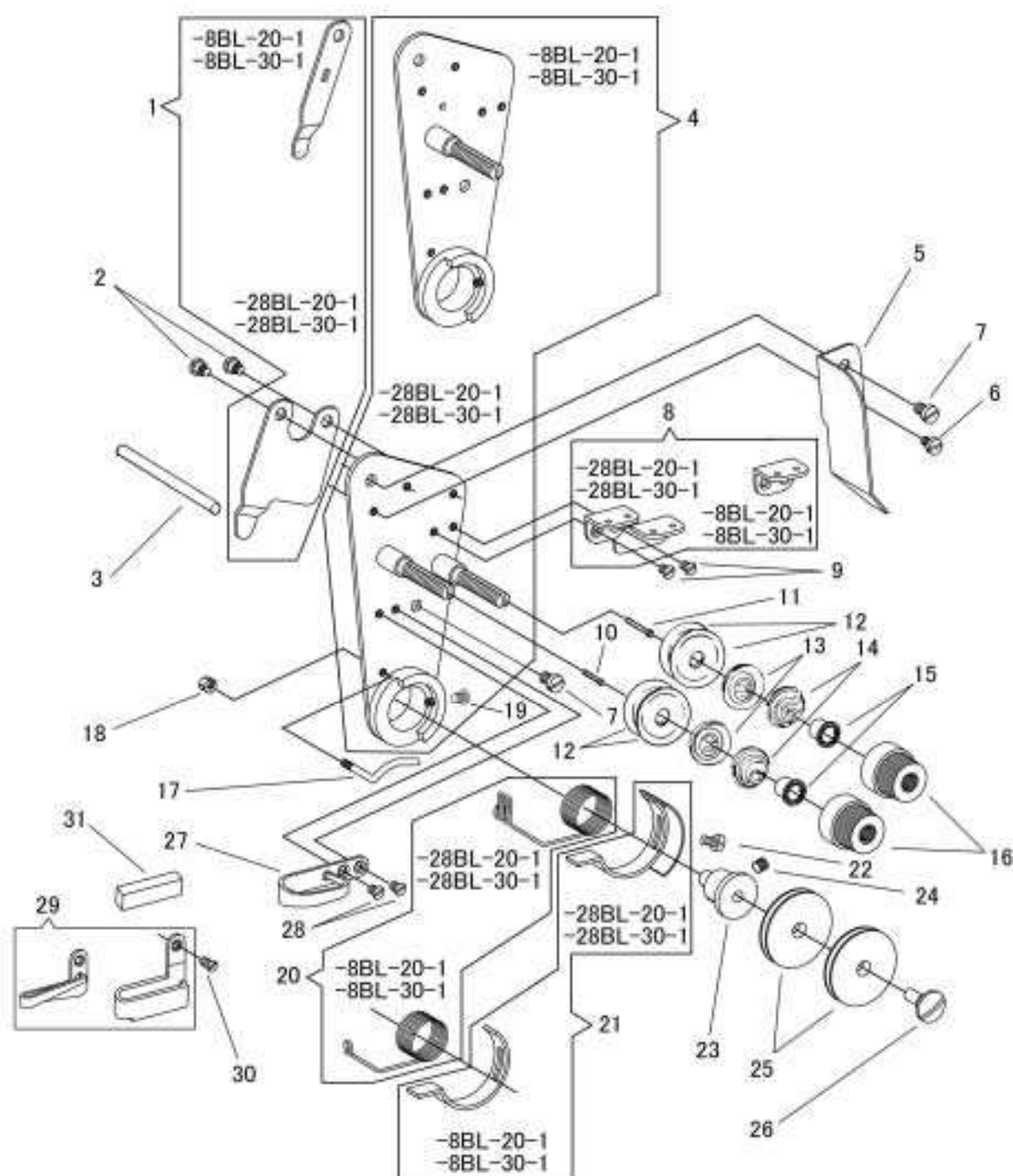
-8BL-20-1
-8BL-30-1

調子板
TENSION BRACKET

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70067	*	-	*	-	1	糸ゆるめ板	TENSION RELEASE PLATE
1	70206	-	*	-	*	1	糸ゆるめ板	TENSION RELEASE PLATE
2	10679	*	-	*	-	1	糸ゆるめ板段ねじ	SCREW 3.4X36 L=2.5
2	10679	-	*	-	*	2	糸ゆるめ板段ねじ	SCREW 3.4X36 L=2.5
3	70074	*	*	*	*	1	糸ゆるめピン	TENSION RELEASE PLUNGER
4	70063C	*	-	*	-	1	調子板 組	TENSION BRACKET COMPLETE
4	70204C	-	*	-	*	1	調子板 組	TENSION BRACKET COMPLETE
5	70075	*	*	*	*	1	糸調子カバー板	THREAD CONTROLLER COVERING PLATE
6	10650	*	*	*	*	1	糸調子カバー板止めねじ	SCREW 3.4X36 L=6.0
7	10561	*	*	*	*	2	止めねじ	SCREW 11/64X32 L=6.5
8	70076	*	-	*	-	1	調子板糸掛 (上)	THREAD CONTROLLER THREAD GUIDE (UPPER)
8	70209	-	*	-	*	1	調子板糸掛 (上)	THREAD CONTROLLER THREAD GUIDE (UPPER)
9	12113	*	*	*	*	2	調子板糸掛 (上)止めねじ	SCREW 3.4X36 L=4.0
10	70066	*	*	*	*	1	糸ゆるめ段ピン 短)	TENSION RELEASE PIN (SHORT)
11	70207	-	*	-	*	1	糸ゆるめ段ピン 長)	TENSION RELEASE PIN (LONG)
12	8077	*	-	*	-	2	糸調子皿	TENSION DISC
12	8077	-	*	-	*	4	糸調子皿	TENSION DISC
13	3071	*	-	*	-	1	丸一皿	TENSION RELEASE WASHER
13	3071	-	*	-	*	2	丸一皿	TENSION RELEASE WASHER
14	8078	*	-	*	-	1	渦巻ばね	TENSION SPRING
14	8078	-	*	-	*	2	渦巻ばね	TENSION SPRING
15	143657	*	-	*	-	1	ラチェット	RATCHET
15	143657	-	*	-	*	2	ラチェット	RATCHET
16	27061	*	-	*	-	1	ローレットナット	REGULATING THUMB NUT
16	27061	-	*	-	*	2	ローレットナット	REGULATING THUMB NUT
17	70078	*	-	*	-	1	調子板糸掛 (下)	THREAD CONTROLLER THREAD GUIDE (LOWER)
17	70210	-	*	-	*	1	調子板糸掛 (下)	THREAD CONTROLLER THREAD GUIDE (LOWER)
18	11067	*	*	*	*	1	調子板糸掛 (下)止めナット	NUT
19	15055	*	*	*	*	1	糸調子カラー受ピン止めねじ	SCREW 11/64X32 L=9.0
20	70072	*	-	*	-	1	糸引スプリング	THREAD CONTROLLER SPRING
20	70221	-	*	-	*	1	糸引スプリング	THREAD CONTROLLER SPRING
21	70073	*	-	*	-	1	糸引スプリング受	THREAD CONTROLLER SPRING STOP
21	70222	-	*	-	*	1	糸引スプリング受	THREAD CONTROLLER SPRING STOP
22	10650	*	*	*	*	1	糸引スプリング受止めねじ	SCREW 3.4X36 L=6.0
23	70070	*	*	*	*	1	糸調子カラー受ピン	THREAD CONTROLLER SPRING STUD
24	12421	*	*	*	*	1	糸調子棒カラー止めねじ	SCREW 11/64X32 L=4.0
25	70069	*	-	*	-	1	糸調子棒カラー	THREAD CONTROLLER DISC
25	70069	-	*	-	*	2	糸調子棒カラー	THREAD CONTROLLER DISC
26	70071	*	-	*	-	1	糸調子棒カラー押えピン	THREAD CONTROLLER STUD
26	70208	-	*	-	*	1	糸調子棒カラー押えピン	THREAD CONTROLLER STUD
27	70077	*	-	*	-	1	調子板糸掛 (中)	THREAD CONTROLLER THREAD GUIDE (MIDDLE)
27	70400	-	*	-	*	1	調子板糸掛 (中)	THREAD CONTROLLER THREAD GUIDE (MIDDLE)
28	12113	*	*	*	*	2	調子板糸掛 (中)止めねじ	SCREW 3.4X36 L=4.0
29	10759-A	-	*	-	*	1	面糸掛 〜1	THREAD GUIDE 〜1
29	10684	-	*	-	*	1	面糸掛 1-3/16〜	THREAD GUIDE 1-3/16〜
30	10685	-	*	-	*	1	面糸掛止めねじ	SCREW 3.4X36 L=6.5
31	10760	-	*	-	*	1	面糸掛フエルト	FELT

押え棒大板バネ、糸巻き
PRESSER BAR SPRING, BOBBIN WINDER

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70091	*	*	*	*	1	ストッパーレバー	FOOT LIFTER LIFTING LEVER LATCH HANDLE
2	2067	*	*	*	*	3	ストッパーレバー止めねじ	SCREW 11/64x40 L=6.0
3	70089	*	*	*	*	1	ストッパーカラー（上）	COLLAR (UPPER)
4	8042	*	*	*	*	1	ストッパーカラー止めねじ	SCREW 11/64X40 L=5.0
5	70088	*	*	*	*	1	ストッパースプリング	FOOT LIFTER LIFTING LEVER LATCH SPRING
6	70090	*	*	*	*	1	ストッパーカラー（下）	COLLAR (LOWER)
7	50287	*	*	*	*	1	ストッパーカラー止めねじ	SCREW 1/8X44 L=5.0
8	70087	*	*	*	*	1	ストッパークランク	FOOT LIFTER LIFTING LEVER LATCH
9	70376	*	*	-	-	1	大弓	FOOT LIFTER LIFTING LEVER
9	70083	-	-	*	*	1	大弓	FOOT LIFTER LIFTING LEVER
10	70084	*	*	*	*	1	大弓ピン	PIN
11	70085	*	*	*	*	1	弓受ピン	FOOT LIFTER LIFTING LEVER HINGE STUD
12	70136	*	*	*	*	1	弓受ピン止めねじ	SCREW 1/4X32 L=9.0
13	70086	*	*	*	*	1	大弓ばね	FOOT LIFTER LIFTING LEVER SPRING
14	10548	*	*	*	*	1	大弓ばね止めねじ	SCREW 6.75X24 L=8.1
15	70060	*	*	*	*	1	押え棒大板ばね	PRESSER BAR SPRING
16	70061	*	*	*	*	1	押え棒大板補助ばね	PRESSER BAR SPRING (AUXILIARY)
17	70094	*	*	*	*	1	大板ばね受ワッシャー	WASHER
18	70121	*	*	*	*	1	大板ばね受ねじ	SCREW 6.75X24 L=13.0
19	70062	*	*	*	*	1	大板ばね調節ねじ	SCREW 6.75X24 L=127.0
20	70101	*	*	*	*	1	糸巻ローラー	BOBBIN WINDER SHAFT DRIVING ROLLER
21	70175	*	*	*	*	2	糸巻ローラー止めねじ	SCREW 11/64X40 L=5.8
22	70100	*	*	*	*	1	糸巻芯棒	BOBBIN WINDER SHAFT
23	70099	*	*	*	*	1	糸巻連結	BOBBIN WINDER LINK
24	70103	*	*	*	*	1	糸巻連結段ねじ	HINGE SCREW 11/64X40
25	70102	*	*	*	*	1	糸巻調節板	BOBBIN WINDER CONNECTING PLATE
26	4094	*	*	*	*	1	糸巻レバー止めねじ	SCREW M4X0.7 L=5.0
26	70104	*	*	*	*	1	糸巻調節板段ねじ	HINGE SCREW 11/64X40 L=4.0
27	70106	*	*	*	*	1	糸巻調節ねじ	SCREW M4X0.7 L=12.0
28	4137	*	*	*	*	1	糸巻調節ねじナット	NUT
29	70107	*	*	*	*	1	糸巻調節板戻しスプリング	BOBBIN WINDER CONNECTING PLATE SPRING
30	70110	*	*	*	*	1	糸巻切り換え軸	BOBBIN WINDER RELEASING LEVER
31	70109	*	*	*	*	1	糸巻レバー	BOBBIN WINDER SET LEVER
32	4094	*	*	*	*	1	糸巻レバー止めねじ	SCREW M4X0.7 L=5.0
33	70108	*	*	*	*	1	糸巻レバースプリング	BOBBIN WINDER SET LEVER RELEASING SPRING
34	70105	*	*	*	*	1	糸巻連結戻スプリング	BOBBIN WINDER LINK RELEASING SPRING
35	70096	*	*	*	*	1	糸巻連結押しピン	STOP STUD
36	70097C	*	*	*	*	1	糸巻取付板（組）	BOBBIN WINDER BRACKET COMPLETE
37	12738	*	*	*	*	1	糸巻きローラーストッパー板	STOPPER PLATE
38	10650	*	*	*	*	1	糸巻きローラーストッパー板止めねじ	SCREW 3.4X36 L=6.0
39	15055	*	*	*	*	4	糸巻取付板止めねじ	SCREW 11/64X32 L=9.0

付属品1
ACCESSORIES 1
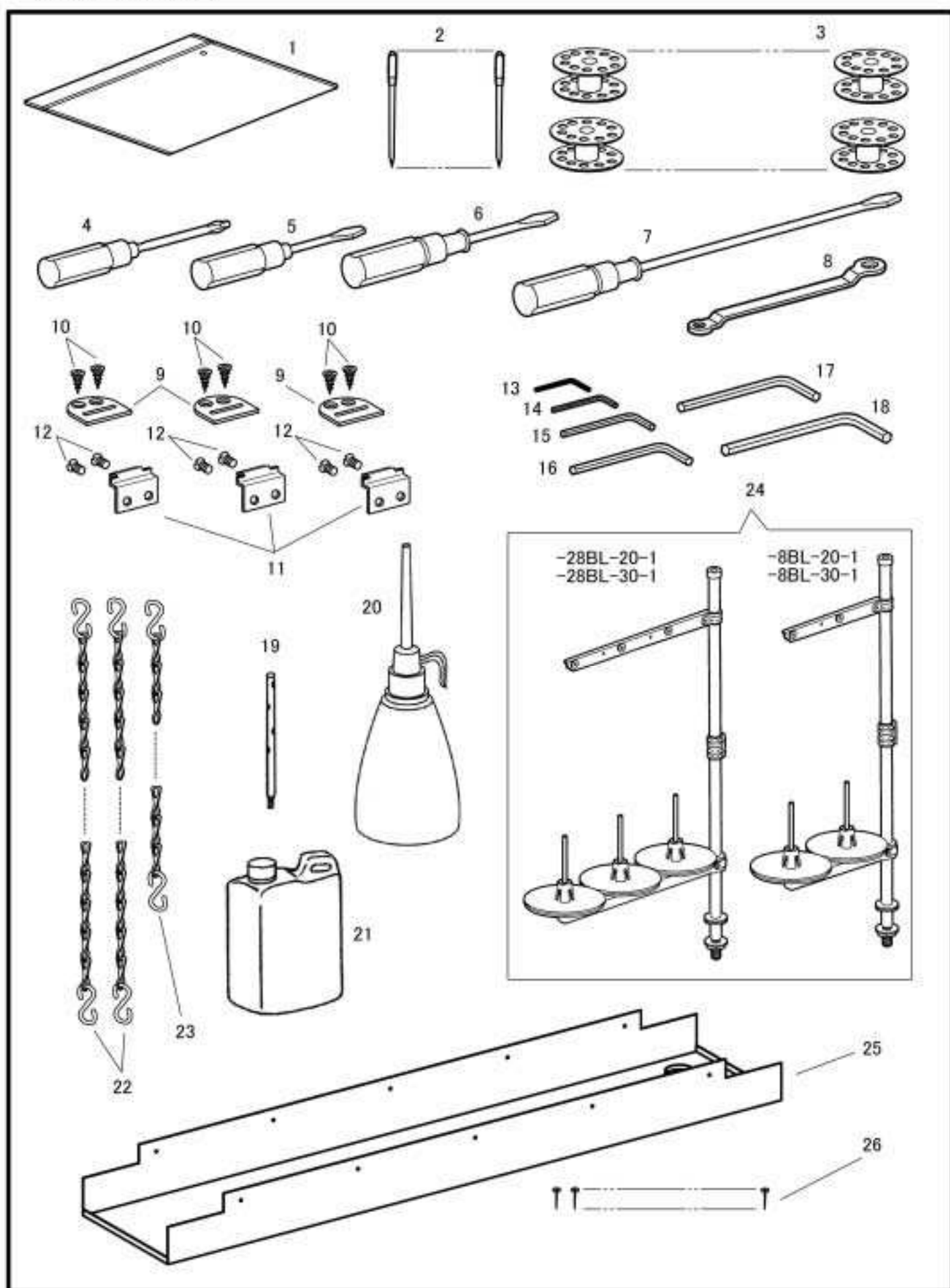
付属品 1
ACCESSORIES 1

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	8132-A	*	*	*	*	1	部品袋チャック付	ACCESSORIES PACK
2	N3324	*	–	*	–	3	針 DYX3 （#24）	NEEDLE DYX3 （#24）
2	N3324	–	*	–	*	6	針 DYX3 （#24）	NEEDLE DYX3 （#24）
3	70141	*	–	*	–	5	ボビン	BOBBIN
3	70141	–	*	–	*	10	ボビン	BOBBIN
4	19473	*	*	*	*	1	十字 ドライバー	SCREW DRIVER （CROSS TYPE）
5	8121	*	*	*	*	1	ドライバー （小）	SCREW DRIVER （SMALL）
6	8120	*	*	*	*	1	ドライバー （中）	SCREW DRIVER （MIDDLE）
7	8118	*	*	*	*	1	ドライバー （大）	SCREW DRIVER （LARGE）
8	19462	*	*	*	*	1	メガネレンチ	DOUBLE HEAD WRENCH
9	11171	*	*	*	*	3	ヒンジ受け	MACHINE HINGE CONNECTION PLATE
10	6052	*	*	*	*	6	ヒンジ受け止め木ねじ	MACHINE HINGE CONNECTION PLATE WOOD SCREW
11	11169	*	*	*	*	3	ヒンジ	BED HINGE
12	11170	*	*	*	*	6	ヒンジ止めねじ	BED HINGE SCREW
13	10747	*	*	*	*	1	六角レンチ （1/16 インチ）	WRENCH （1/16 "）
14	19456	*	*	*	*	1	六角レンチ （2 ミリ）	WRENCH （2 mm）
15	19457	*	*	*	*	1	六角レンチ （2.5 ミリ）	WRENCH （2.5 mm）
16	19458	*	*	*	*	1	六角レンチ （3 ミリ）	WRENCH （3 mm）
17	19459	*	*	*	*	1	六角レンチ （4 ミリ）	WRENCH （4 mm）
18	19460	*	*	*	*	1	六角レンチ （5 ミリ）	WRENCH （5 mm）
19	10942	*	*	*	*	1	糸立棒	THREAD GUIDE
20	8125	*	*	*	*	1	油差し	OILER
21	11193	*	*	*	*	1	油	OIL
22	13079	*	*	*	*	2	くさり(1000 mm)	CHAIN (1000 mm)
23	70197	*	*	*	*	1	くさり(90 mm)	CHAIN (90 mm)
24	10947	–	*	–	*	1	糸立てセット	THREAD STAND
24	35254	*	–	*	–	1	糸立てセット	THREAD STAND
25	70377	*	*	–	–	1	油受け	DRIP PAN
25	70171	–	–	*	*	1	油受け	DRIP PAN
26	6055	*	*	–	–	8	釘	NAIL
26	6055	–	–	*	*	10	釘	NAIL
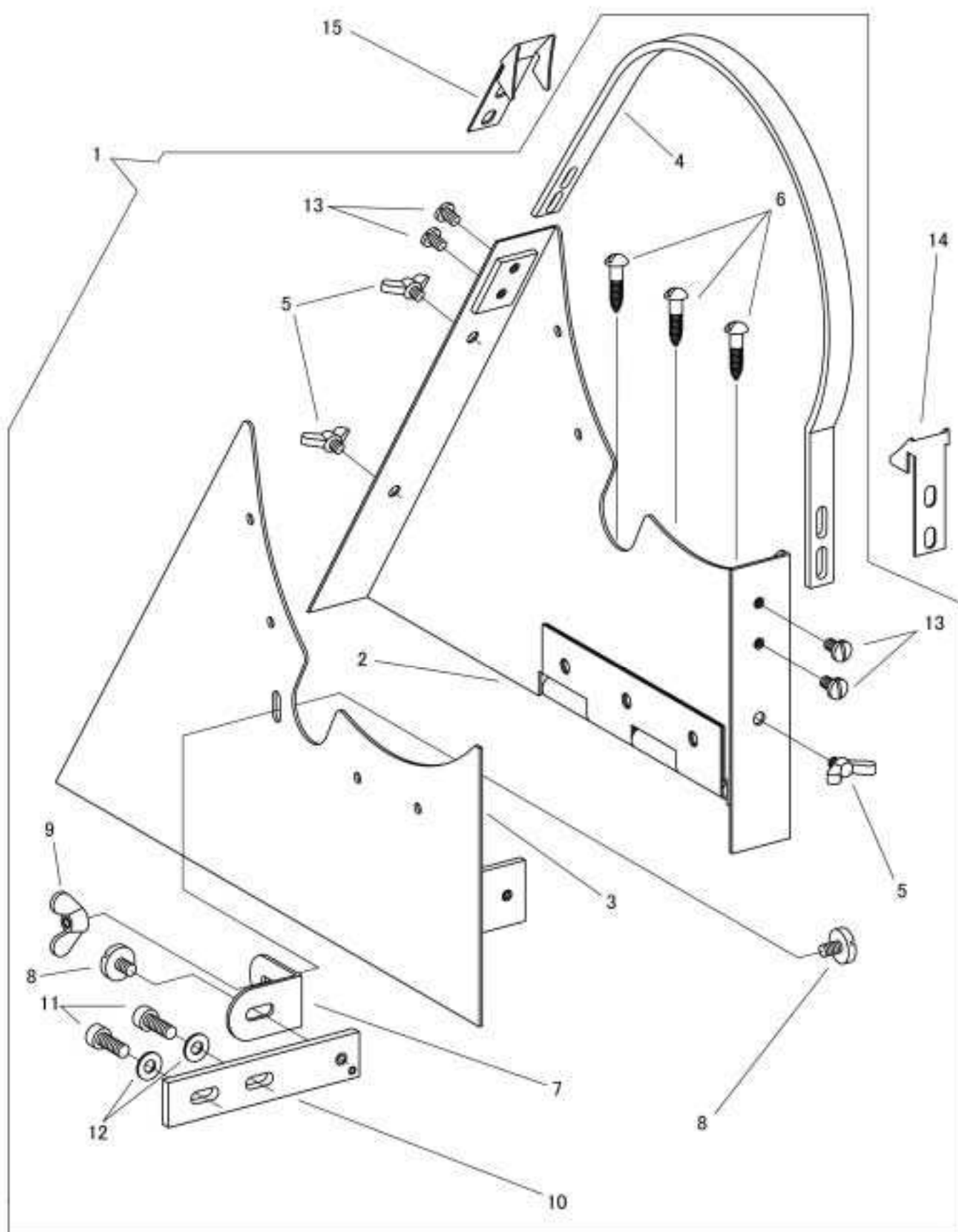
付属品 2
ACCESSORIES 2

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	70199DC	*	*	*	*	1	ベルトガード 組)	BELT GUARD COMPLETE
2	70199-A	*	*	*	*	1	ベルトガード 右)	BELT GUARD (RIGHT)
3	70199-B	*	*	*	*	1	ベルトガード 左)	BELT GUARD (LEFT)
4	70199-C	*	*	*	*	1	ベルトカバー	BELT GUARD COVER
5	28080	*	*	*	*	3	ベルトガード 右) 左)止め蝶ねじ	SCREW M5X0.8 L=6.0
6	70215	*	*	*	*	3	ベルトガード止め木ねじ	WOOD SCREW
7	70199-E	*	*	*	*	1	ベルトガード振れ止め板	BELT GUARD STAY
8	12386	*	*	*	*	2	ベルトガード振れ止め板止めねじ	SCREW 7/32X32 L=9.0
9	10776	*	*	*	*	1	ベルトガード振れ止め板止め蝶ナット	WING NUT
10	70199-D	*	*	*	*	1	ベルトガード振れ止め受板	BELT GUARD SUPPORT
11	28076	*	*	*	*	2	ベルトガード振れ止め受板止めねじ	SCREW M6X1 L=18
12	10599	*	*	*	*	2	ベルトガード振れ止め受板止めねじワッシャー	WASHER
13	12418	*	*	*	*	4	ベルトカバー止めねじ	SCREW 13/64X32 L=9.0
14	70199-F	*	*	*	*	1	補助ガード 前) （CE用)	AUXILIARY GUARD (FRONT) : for CE
15	70199-G	*	*	*	*	1	補助ガード 後) （CE用)	AUXILIARY GUARD (REAR) : for CE

別売品
PARTS AVAILABLE AT EXTRA CHARGE

No.	部品番号 PARTS NO.	-8BL-20-1	-28BL-20-1	-8BL-30-1	-28BL-30-1	数量 QTY	品名	DESCRIPTION
1	30169	*	*	*	*	1	検出器アダプター	ADAPTOR FOR SYNCHRONIZER
2	30170	*	*	*	*	3	検出器アダプター止めねじ	SCREW M4×0.7　L=16.0
3	31208	*	*	*	*	3	検出器アダプター止めばね座金	SPRING LOCK WASHER
4	70189	*	*	*	*	1	検出器支え棒(組）	SYNCHRONIZER SUPPORT

ゲージ表
TABLE OF GAUGE PARTS

GAUGE SIZE (inch)	(mm)	針棒 針抱付 NEEDLE BAR WITH CLAMP	中押え VIBRATING PRESSER FOOT	外押え LIFTING PRESSER FOOT	針板 THROAT PLATE	送り歯 FEED DOG	角板 左 BED SLIDE (LEFT)	角板 右 BED SLIDE (RIGHT)	フィンガーガード FINGER GUARD
-	5	70225-03	70226-03	70227-03	70228-03	70229-03	70218	70224	70219-02
1/4	6.4	70230	70250	70270	70290	70310	70218	70224	70219-02
5/16	7.9	70232	70252	70272	70292	70312	70348	70368	70219-02
-	8.3	70248	70268	70288	70308	70328	70348	70368	70219-02
3/8	9.5	70233	70253	70273	70293	70313	70333	70353	70219-03
-	10	70249	70269	70289	70309	70329	70333	70353	70219-03
7/16	11.1	70234	70254	70274	70294	70314	70335	70355	70219-04
1/2	12.7	70235	70255	70275	70295	70315	70335	70355	70219-04
-	14	70236-B	70256-B	70276	70296	70316-B	70335	70355	70219-04
9/16	14.3	70236-A	70256-A	70276	70296	70316-A	70335	70355	70219-04
-	15	70225-01	70226-01	70227-01	70228-01	70229-01	70337	70357	70219-04
5/8	15.9	70237	70257	70277	70297	70317	70337	70357	70219-04
3/4	19.1	70238	70258	70278	70298	70318	70338	70358	70219-05
7/8	22.2	70239	70259	70279	70299	70319	70339	70359	70219-06
1	25.4	70240	70260	70280	70300	70320	70340	70360	70219-07
1-3/16	30.2	70241	70261	70281	70301	70321	70342	70362	70219-09
1-1/4	31.8	70242	70262	70282	70302	70322	70342	70362	70219-09
1-3/8	34.9	70243	70263	70283	70303	70323-S	70343	70363	70219-09
1-1/2	38.1	70244	70264	70284	70304	70324	70344	70364	70219-09
1-5/8	41.3	70225-05	70226-05	70227-05	70228-05	70229-05	70341	70361	70219-08
1-3/4	44.5	70245	70265	70285	70305	70325	70345	70365	-
2	50.8	70246	70266	70286	70306	70326-S	70346	70366	-
2-1/4	57.2	70460	70465	70470	70475	70480	70490	70485	-
2-3/8	60.3	70247	70267	70287	70307	70327	70347	70367	-
2-1/2	63.5	70225-02	70226-02	70227-02	70228-02	70229-02	70349	70369	-

EMERALD

EMC-2005

INSTRUCTION BOOK

ERRATA SHEET, IB-20B004 REV. 0   JUNE 2007

ate	Rev.	ECN No.	DR	CHK	CHK
7/19/05	0	ECN-05-252 (See Note 1)	KY	KY	
1/6/06	A	ECN-05-437 (See Note 2)	KY	KY	
8/8/06	B	ECN-06-188 (See Note 3)	KY	CD	
6/1/07	C	ECN-07-162 (See Note 4)	KY	KY	

Notes:

1) Page 3-1, dated July 2005, supersedes page 3-1, dated May 2005.

2) Added End User License Agreement to Appendix F.

3) Table of Contents, page iii, List of Illustrations, page vii, and Section 4, dated August 2006, supersedes Table of Contents, page iii, List of Illustrations, page vii, and Section 4, dated May 2005.

4) Appendix B, dated June 2007, supersedes Appendix B, dated May 2005.

TABLE OF CONTENTS

SECTION 1 - OVERVIEW

SECTION 2 - DESCRIPTION

SECTION 3 - EMERALD SPECIFICATIONS

SECTION 4 - EMERALD WIRING

SECTION 5 - STATUS & ERROR CODES

SECTION 6 - INSTALLATION GUIDELINES

SECTION 7 - CABLES AND ACCESSORIES

APPENDIX A - MODEM PMC OPTION BOARD

APPENDIX B - ETHERNET PMC ETHERNET BOARD

APPENDIX C - MASTER RESOLVER PMC OPTION BOARD

LIST OF ILLUSTRATIONS

SECTION 1 - OVERVIEW

SECTION 2 - DESCRIPTION

SECTION 3 - EMERALD SPECIFICATIONS

SECTION 4 - EMERALD WIRING

SECTION 5 - STATUS & ERROR CODES

SECTION 6 - INSTALLATION GUIDELINES

SECTION 7 - CABLES AND ACCESSORIES

APPENDIX A - MODEM PMC OPTION BOARD

APPENDIX B - ETHERNET PMC ETHERNET BOARD

APPENDIX C - MASTER RESOLVER PMC OPTION BOARD

APPENDIX D - FIBER OPTIC MASTER PMC OPTION BOARD

APPENDIX E - SMARTMEDIA MEMORY PMC OPTION BOARD

APPENDIX F - EMBEDDED PC PMC OPTION BOARD

INTRODUCTION

Thank you for selecting Industrial Indexing Systems' Emerald Series products. You join many other companies around the world in your choice of these powerful, flexible motion control products.

The EMC-2005 embodies a blend of open architecture features with a true real-time operating system. The result is a state-of-the art performance and superior connectivity to other systems and network components.

The EMC-2005 has a wide array of features, including a 64-bit MIPS processor, SERCOS Interface™, DeviceNet/CanBus port, two RS-232 ports, Encoder master follower input, programmmable limit switch (PLS) Functions, 2 software simulated motors (pacers), failsafe watchdog timer and high visibility status displays. The EMC-2005 also offers 2 PCI Mezzanine slots (PMC) for interfacing a large selection of optional features, including a master follower resolver, Ethernet, removable memory, embedded PC and modem.

The controller is programmed using our friendly **E**merald **M**otion **P**rogramming **L**anguage (EML) and powerful new **E**merald **D**evelopment **E**nvironment (EDE) software tools for the PC.

SECTION 1 - OVERVIEW

This manual is organized so that information is easy to find and easy to use. It begins by detailing how to identify the EMC-2005 Controller and its options. This section is followed by a general description of the product and its components. Next, a comprehensive hardware specification is provided followed by connector wiring diagrams. The section that follows documents the controller status displays. Sections on EMC-2005 installation guidelines and cables drawings round out the manual.

1.1   IDENTIFYING THE EMERALD CONTROLLER

Emerald Controller packages can be identified as follows.

Your EMERALD Controller model number uses this designation:

EMC-2005XXX

WHERE:
XXX = option list in alphabetical order

E = Ethernet Single Slot PMC Card
B = Removable memory port single slot PMC card
R = Master resolver single slot PMC card
P = Embedded PC dual slot PMC card
M = Modem single slot PMC card
S = DeviceNet Scanner Software

Example: EMC-2005ERS

DeviceNet Scanner Software
Master Resolver PMC
Ethernet PMC
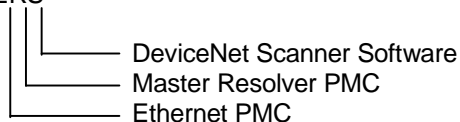
SECTION 2 - DESCRIPTION

The Emerald EMC-2005 product is a SERCOS Master servo motion controller, with the ability to command up to 16 SERCOS Slave Devices. The application program that operates the controller is created on a PC using the EDE software tools and sent serially to the controller via an RS-232 link.

> **NOTE**
> **All commands used by the EMERALD are part of the Emerald Motion Language (EML). Refer to the Emerald Development Environment (EDE) PC tools online help for detailed information on the commands and their proper usage.**

The external connections that exist on the Emerald are shown in **Figure 2.1**, and consist of 2 RS-232 ports, DeviceNet/Can Bus port, Master Encoder Input, SERCOS Transmitter and Receiver, as well as a Hardware Watchdog and power connections.

Error! No topic specified.

Figure 2.1 - Emerald Layout

2.1   COMPONENTS

2.1.1   STATUS INDICATORS

> **NOTE**
> For indicator status information, refer to Section 5 - Status & Error Codes.

1. Controller Status Display - This single seven-segment LED display with decimal point provides status information of various operating conditions.

2. SERCOS Status LEDs - This 4 LED Array indicates the status of the SERCOS Interface^{TM}.

3. DeviceNet Status LEDs - The combination of these 2 bi-color LEDs indicates the status of DeviceNet network or Can Bus.

2.1.2   CONNECTORS

> **NOTE**
> For proper pinouts for each connector refer to Section 4 - Emerald Wiring.

1. PORT 1 - This 6-pin RJ-11 connector is an RS-232 serial communication port. It uses a custom protocol to communicate with the EDE software tools on a PC. This port also facilitates firmware download.

2. PORT 2 - This 6-pin RJ-11 connector is an RS-232 serial communication port. It can be used to communicate with the IIS OPI-50 or similar RS-232 type device. The protocol is selectable through the EML programming language. This port does default to the custom protocol for communicating with the EDE software tools on a PC.

3. PORT 3 - This 5-pin header is a DeviceNet/Can Bus interface port. The Emerald can operate as both a slave (standard) and master scanner (optional) on a DeviceNet network. EML program data and EMERALD System Status Flags can be sent or monitored over this Network

4. ENCODER - This 10-pin header is a high-speed master encoder pulse input.

5. WD/24V - This connector is used to connect the required 24VDC external power supply. This connector also provides a normally open hardware watchdog output for external monitoring of the EMERALD operation. The watchdog output contact will be closed when the Motion Application is executing.

6. RX - This SMA style interface port is the SERCOS Fiber Optic Receiver. This is return connection for SERCOS Interface Ring.

7. TX - This SMA style interface port is the SERCOS Fiber Optic Transmitter. This connection is the start of the SERCOS Interface Ring.

SECTION 3 - EMERALD SPECIFICATIONS

3.1   GENERAL

Weight	5.8 lbs / 2.2 Kgs
Dimensions	Width 4.80 in (121.9 mm) Height 12.5 in (317.4 mm) Depth 7.28 in (184.8 mm)
Recommended Panel Depth	12.00 in (304.8 mm) (See **Section 6 - Installation Guidelines**)

3.2   POWER REQUIREMENT

Supply Voltage	24 volts DC $\pm$ 10%, Class 2 power supply
Supply Current	.75 amps max. with no PMC option cards installed.

3.3   SERCOS INTERFACE

Interface Version	V01.02
Topology	Multi drop fiber optic ring
Transmission Rates	2, 4, 8 and 16 MB/second

3.4   ENVIRONMENT

Storage Temperature	-10 to 70°C/14-158°F
Operating Temperature	0 to 50°C/32-122°F
Humidity	35 to 90% Relative Humidity, non-condensing
Shock and Vibration	1 G or less
Operating Conditions	Free of dust, liquids, metallic particles and corrosive gases. Use in a pollution degree 2 environment.

3.5 COMMUNICATION PORTS

Port 1	Classification: RS-232 Data Transfer: EMC Packet protocol Protocol: 38400 baud, 1 stop bit, 8 data bits, No parity
Port 2	Classification: RS-232 Data Transfer: EMC Packet protocol (default), Programmable Protocol: Configurable
DeviceNet / CAN Bus	Classification: CAN bus DeviceNet: Data Transfer and Protocol are defined by the DeviceNet specifications. OR CAN Bus: IIS unique software protocol for easy to use multidrop control. **Reference IB-11B023**.
Fiber Optic Transmitter/ Receiver	Classification: SMA style - SERCOS compatible Fiber Optics SERCOS: Data Transfer and Protocol are define by the SERCOS Specification (IEC-61491 or EN-61491).

3.6 ENCODER INTERFACE

A quad B with marker	Three differential Inputs. Input Frequency DC to 1.5 MHz. ON: 5V±5% @ 20mA max. OFF: 1V±5% less than 1mA.
Trap	Input for trapping encoder's 32 bit signed position. 24V±10% @ 10 mA max. Max. Trap Rate 1 kHz. Trap Register is updated on falling edge of input. Consult factory for availability of rising edge Trap Input.

3.7 WATCHDOG PROTECTION

Contact Type	Relay normally open dry contact
Rating	Up to 28 VAC/VDC, 1.0 Amp Maximum

SECTION 4 - EMERALD WIRING

This section details the pinouts of the external connectors on the EMERALD controller. Refer to **Section 7 INTERFACE CABLES** for part numbers of cables to interface to these connectors.

4.1   PORT 1 & PORT 2

The ports are used for communication and use RJ-11 connectors to interface to respective devices. The port 1 & port 2 pinouts are shown in **Figure 4.1**.

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Figure 4.1 - Port 1 & Port 2

4.2   PORT 3 (DeviceNet/Can Bus)

DeviceNet/Can Bus is to be powered by a 12 to 24 volt, Class 2 power supply.

The DeviceNet/Can Bus pinouts are shown in **Figure 4.2**.

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Figure 4.2 - DeviceNet/CAN Bus

4.2.1 WIRING RECOMMENDATIONS

A.   A termination resistor at either end of the Can Bus trunk.
- Termination Resistor Specifications
        121 ohm
        1% Metal Film
        ¼ Watt

B.   Ideally the Drain Wire (pin-3) should be tied to the supply ground at the power supply. At that power supply the ground should be tied to earth.

C.   DeviceNet Specifications for further wiring concerns can be found with the Open DeviceNet Vendors Association (ODVA).
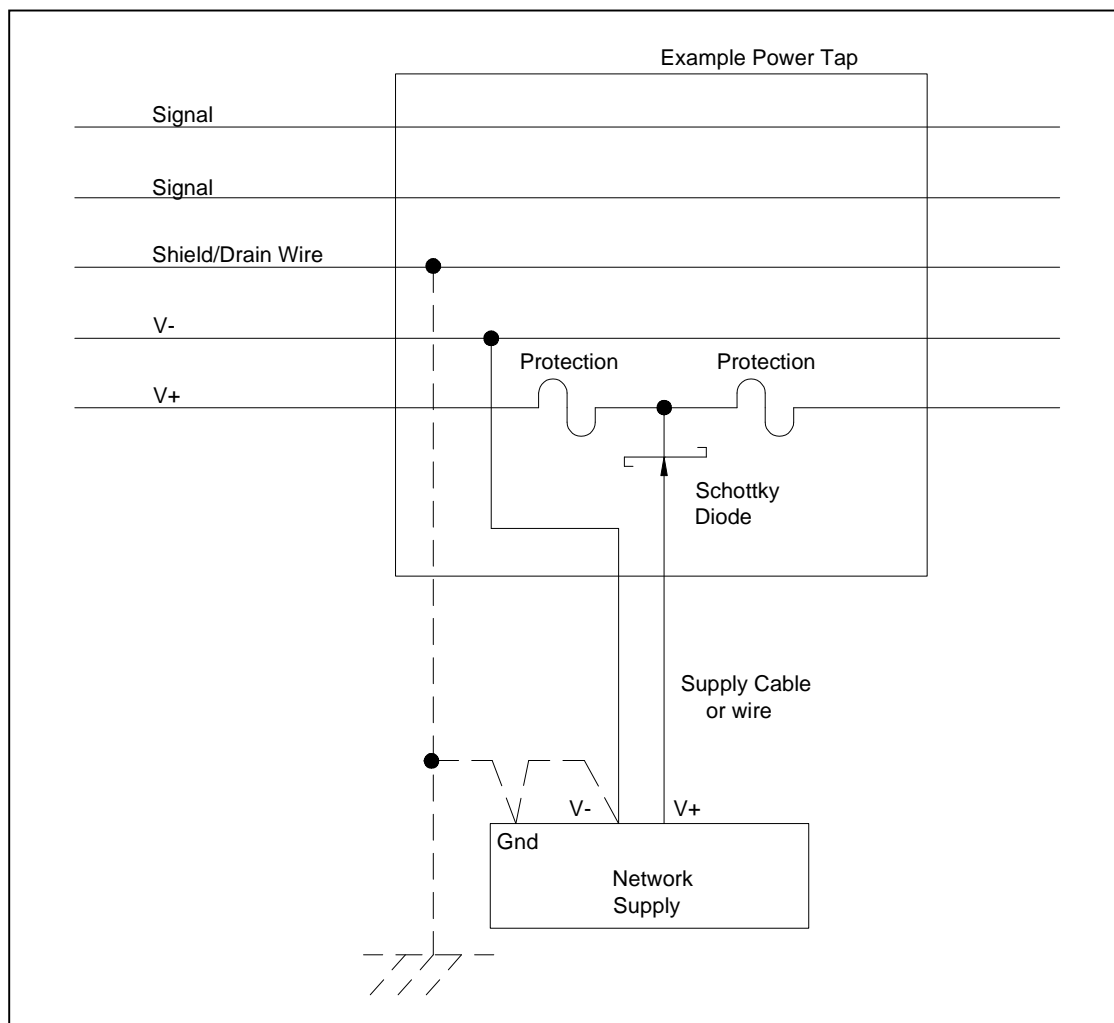
Figure 4.3 - Diagram of DeviceNet Power Tap

4.3 ENCODER INTERFACE

The Encoder interface connector pinouts are shown in **Figure 4.4**.
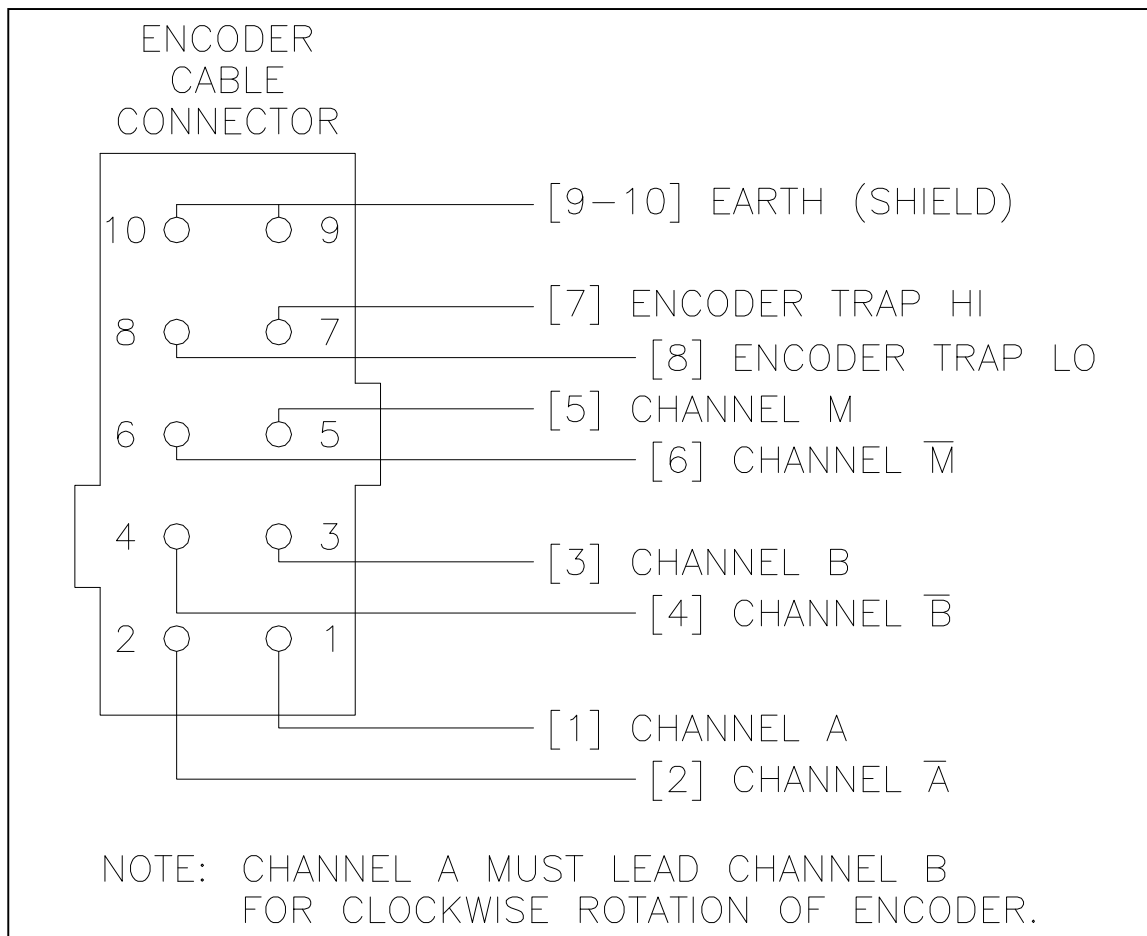
Figure 4.4 - Encoder Interface Connector Pinouts

4.4 POWER AND WATCHDOG CONNECTER

The 24-volt, Class 2 power supply is to be used to power the EMC-2005.

The pinouts of the WD/24V connector are shown in **Figure 4.5**.
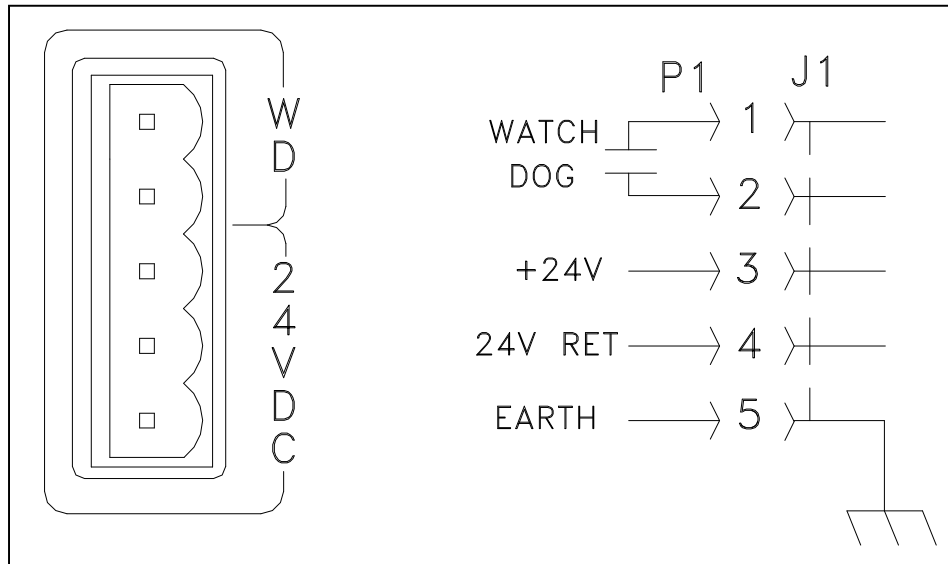
Figure 4.5 - Power and Watchdog Connection

4.5 SERCOS INTERFACE TX/RX

The SERCOS Interface[TM] is a multi-drop fiber-optic ring with 1 Master Controller command multiple Slave devices. The EMERALD acts as the Master Controller in this arrangement.
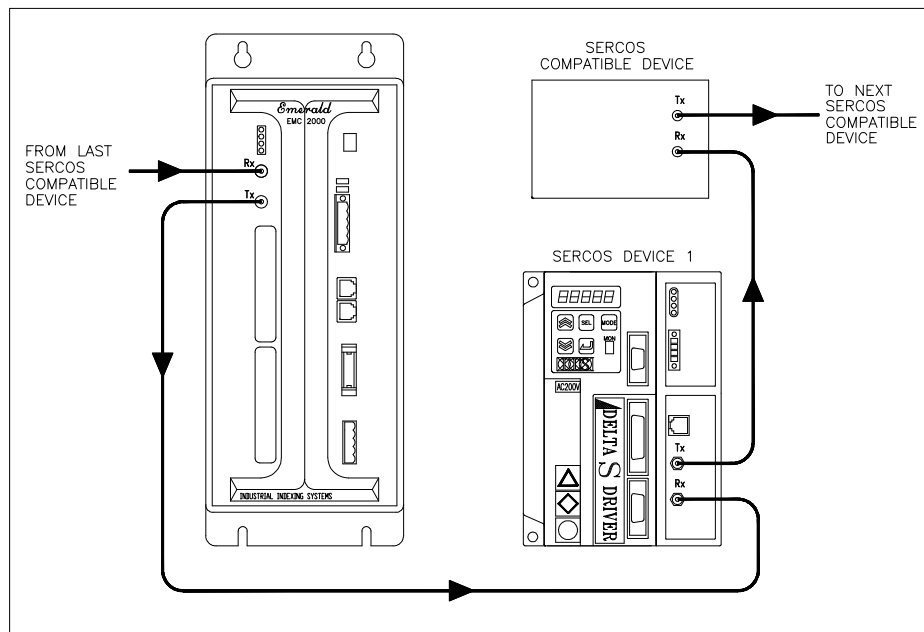
Figure 4.6 - Typical SERCOS Ring

SECTION 5 - STATUS & ERROR CODES

5.1   CONTROLLER STATUS

Error! No topic specified.
Figure 5.1 - Controller Status

5.2 SERCOS STATUS DISPLAYS
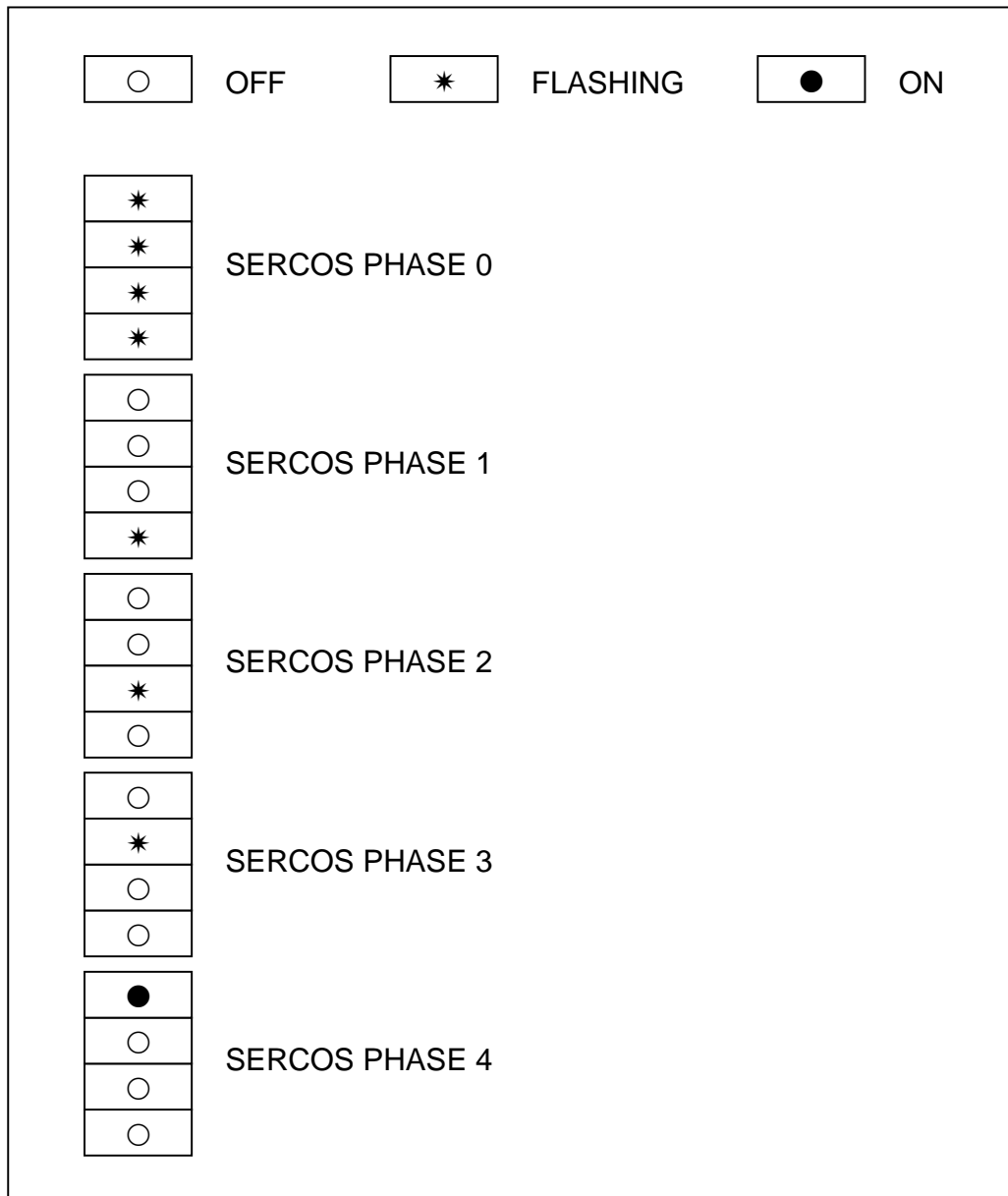
Figure 5.2 - SERCOS Status Displays

5.3   DEVICENET STATUS DISPLAYS FOR PORT 3

NETWORK STATUS

MODULE STATUS

Figure 5.3 - DeviceNet

5.3.1   MODULE STATUS LED

The lower bi-color (green/red) LED provides DeviceNet device status. It indicates whether or not the device has power and is operating properly. **Table 5.1** and **Figure 5.3** define the Module Status LED states.

STATE	LED IS	TO INDICATE
No Power	Off	There is no power applied to the device.
Device Operational	Green	The device is operating in a normal condition.
Device in Standby (The Device Needs Commissioning)	Flashing Green	The device needs commissioning due to configuration missing, incomplete or incorrect. The device may be in the standy state.
Minor Fault	Flashing Red	Recoverable fault.
Unrecoverable Fault	Red	The device has an unrecoverable fault; may need replacing.
Device Self Testing	Flashing Red & Green	The device in self-test.

Table 5.1 - Module Status LED

5.3.2 NETWORK STATUS LED

The upper bi-color (green/red) LED indicates the status of the communication link.

Table 5.2 defines the Network Status LED states.

STATE	LED IS	TO INDICATE
Not Powered/Not On-line	Off	Device is not on-line. - The device has not completed the Dup_MAC_ID test yet. - The device may not be powered, look at Module Status LED.
On-line, Not Connected	Flashing Green	Device is on-line but has no connections in the established state. - The device has passed the Dup_MAC_ID test, is on-line, but has no established connections to other nodes. - For a Group 2 Only device it means that this device is not allocated to a master. - For a UCMM capable device it means that the device has no established connections.
Link OK On-Line, Connected	Green	The device is on-line and has connections in the established state. - For a Group 2 Only device it means that the device is allocated to a Master. - For a UCMM capable device it means that the device has one or more established connections.
Connection Time-Out	Flashing Red	One or more I/O Connections are in the Timed-Out state.
Critical Link Failure	Red	Failed communications device. The device detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID or Bus-off).
Communication Faulted and Received an Identify Comm Fault Request - Long Protocol	Flashing Red & Green	A specific Communication Faulted device. The device has detected a Network Access error and is in the Communication Faulted state. The device has subsequently received and accepted an Identify Communication Faulted Request - Long Protocol message.

Table 5.2 - Network Status LED

SECTION 6 - INSTALLATION GUIDELINES

6.1   GENERAL

This section contains the specific information needed to properly install the Emerald EMC-2005 controller unit. For maximum performance it is recommended that the controller unit be installed in a NEMA 12 type enclosure and certain other criteria be met.

6.2   ENCLOSURE CABINET REQUIREMENTS

Ideally, the EMC-2005 controller unit, along with other related electronic components, should be mounted on a panel housed in a NEMA 12 enclosure. It is recommended that the cabinet have a depth of 12.00 inches (304.8 mm) to accommodate the bend radius of the SERCOS fiber optic cables. The enclosure should be mounted as far away as practical from noise generating devices, such as SCR equipment.

6.3   MOUNTING THE SYSTEM UNIT

The EMC-2005 controller unit is designed for mounting on a grounded panel, and is secured to the panel with four #10 screws. Be sure to provide adequate spacing around the controller unit for ease of maintenance and proper ventilation. Typically wire ways can be located up to 3 inches (76 mm) from the edge of the controller unit back plate. Refer to drawing number EMC-2005 in **Section 6.7 - Installation Drawings** for mounting dimensions.

6.4   CABLE ISOLATION REQUIREMENTS

It is imperative that any low-voltage signal conductors, such as resolvers, encoders or communications, (24V or less) be routed in conduits or wire ways separate from high-voltage, such as motor cables, and transformer lines (100V or more). This will insure that electromagnetic fields produced by high power transmission do not corrupt the low level signals. All cabling shields must be connected according to manufacturer specifications.

6.5   GROUNDING REQUIREMENTS

The site must have a suitable earth ground rod and ground bus installed. The NEMA 12 enclosure, wire ways, conduits, and machine frame must be connected to this ground bus. The EMC-2005 earth ground must be connect to this ground bus.

6.6   POWER ISOLATION

Although the unit is equipped with a fuse and transient voltage protection, it is recommended that the EMC-2005 unit be connected to a separate 24 VDC power supply than the supply used for system I/O. This will isolate noisy I/O contacts from the controller power.

6.7   INSTALLATION DRAWINGS

DRAWING NUMBER   **DESCRIPTION**

EMC-2005   Emerald Controller

Error! No topic specified.

SECTION 7 - CABLES AND ACCESSORIES

DRAWING NUMBER   DESCRIPTION

C-752YYY   SERCOS Fiber Optic Cable, External
C-753YYY   SERCOS Fiber Optic Cable, Internal
C-822YYY   Adaptor Cable
C-987YYY   Modular Data Cable
INT-810   Encoder Cable Adapter

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APPENDIX A - MODEM PMC OPTION BOARD

A.1 MODEM OVERVIEW

The PMC-Modem option board for the Emerald Motion Controller (EMC-2005) has been developed around the Conexant Smart Socket Modem; refer to "www.conexant.com".

The PMC-Modem is a 33.6KBaud modem.

The Emerald Development Environment (EDE) fully supports connection remotely over the phone lines to the EMC-2005 with a PMC-Modem installed.

The PMC-Modem once installed into the EMC-2005 from the factory is configured to Auto-Answer a phone line connection. It will also auto-negotiate the carrier and data baud rates of the United States by just connecting to a direct phone line.

Operation of the PMC-Modem outside the United States can be achieved with minor setup changes to the modem.

A.2 POWER REQUIREMENT

The PMC-Modem option board requires an addition 2.5 watts maximum from the EMC power supply, therefore when sizing the 24VDC power supply for the EMC-2005 be a little generous and add about .5 Amps of current for each Modem installed.

A.3 WIRING

The PMC-Modem accepts a standard phone RJ11 connector, therefore RING is on PIN-3 and TIP is on PIN-4.

A.4 EDE SETUP FOR MODEM COMMUNICATION

The EDE is a PC Windows application developed by Industrial Indexing Systems to program the Emerald Motion Controller. The EDE can be configured to communicate remotely with the EMC via RS232, ETHERNET, or MODEM.

For remote access to the EMC-2005 with a PMC-Modem it is necessary to configure the EDE for communication via modem. It is required that the PC running the EDE has an installed modem.

A.4.1 SELECT MODEM FOR CONNECTION

From EDE tool bar go to **Setup** then select **Communication**, once the screen for connection Type appears select **Modem** as shown below.
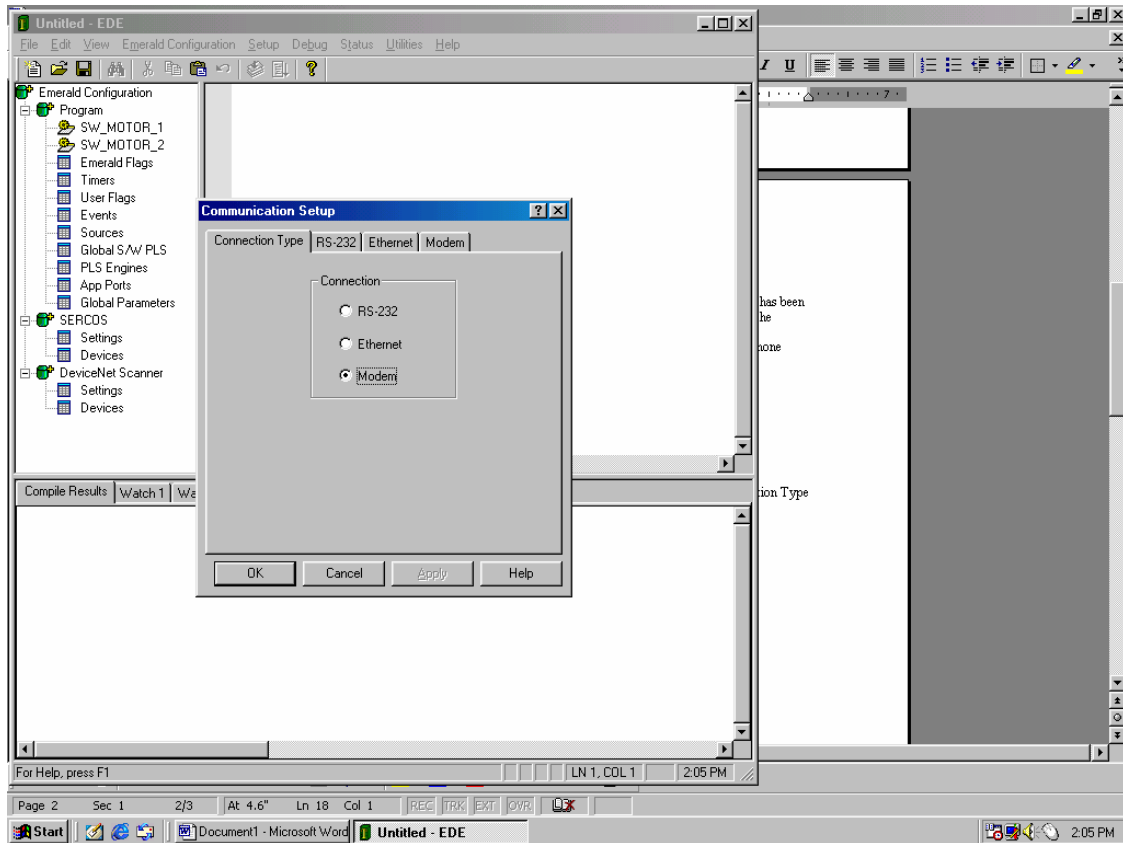
A.4.2   MODEM EDE CONFIGURATION SCREEN

When the EDE is not connected to a controller the modem settings for the PC in which the EDE is running from can be change from the Modem Communication Setup Screen as seen below.
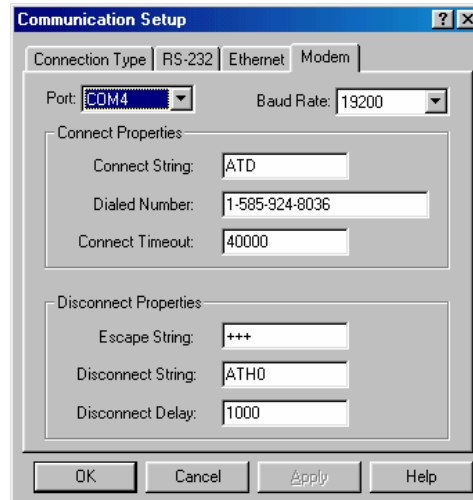
Port: Allows selection of the COM port in which the modem resides on the development platform (PC). The COM port for the modem in any PC running Windows 98 and higher may be gotten from the System display in the Control Panel.

1. Double Click on My Computer from the Windows Desk Top.
2. Double Click on Control Panel.
3. Double Click on Modem.
4. Select Desired Modem from Pull down then click on properties.

Baud Rate: Allows user selection for desired bit rate. The PMC-Modem will operate up to a Baud Rate of 28800, however depending on phone line integrity slower rates may have to be used for error free operation. It's possible to select the highest rate available and let the modems auto-negotiate to the best rate under current line conditions.

A.4.3   CONNECTION PROPERTIES

Connect String: Allows user selection of the string to originate a call via the modem. Most modems will work with a setting of ATD; this is an ASCII Terminal Command to the modem.

Dialed Number: Allows user to select the phone number to connect to the EMC-2005. For the EDE to connect to an EMC-2005 with a Modem, the EMC-2005 needs to be plugged into a phone line, this phone line must have a number to be entered here.

NOTE
The EMC-2005 modem should be plugged into a direct phone line and not one in which the line goes thru an operator or switchboard.

Connection Timeout: Allows the user select the amount of time to wait for the connection to the EMC-2005 to take place.

A.4.4 DISCONNECT PROPERTIES

Escape String: Allows user selection of string to tell the modem to drop from data mode and accept ASCII Terminal Commands.

Disconnect String: Allows user selection to tell the modem to Hang-Up. Most modems will work with a setting of ATH0; this is an ASCII Terminal Command.

Disconnect Delay: Allows the user to select the time in which the EDE should wait for the modem to disconnect.

A.5   EMC ASCII TERMINAL MODE

ASCII Terminal mode is a typical means of communicating with any modem directly no matter what the platform it resides. ASCII Terminal communication is accomplished over Port 1 of the EMC-2005 to the modem plugged into one of the EMC's PMC Option Slots. To communicate to the PMC-Modem in this manner it is necessary to use a terminal emulator such as HyperTerminal. HyperTerminal is shipped with most Microsoft Windows Products, it can be found in the Accessories/Communications folder.

HyperTerminal Setup/Properties:
1. Connect using: Direct to COMx
2. Configure
    a. Bits per second: 38400
    b. Data bits: 8
    c. Parity: None
    d. Stop bits: 1
    e. Flow Control: None
3. ASCII setup:
    a. Enable typed characters locally.

In step 1 above, replace COMx with the COM port of the PC in which the modem resides. For instance, if the modem in the PC was configured on the fourth COM Port use COM4.

Once ASCII Terminal Emulator is setup type in "AT?<cr>" for the EMC's ASCII Terminal help screen to be displayed.

If characters are not displayed in the ASCII Terminal window as they are typed in, the user may ask the EMC-2005 to echo them by typing in "AT;E1<cr>".

NOTE: <cr> is the Enter key on the PC keyboard.

A.6   PMC-MODEM LEDS

The PMC-Modem has four status LEDs; see description below:

Tx: A green LED that turns on when ever the PMC-Modem is transmitting data out the phone line.

Rx: A yellow LED that turns on when ever the PMC-Modem is receiving data from the phone line.

On: A green LED with three statuses:

- FLASHING - When the Modem phone line is ringing for the EMC Modem to pick up.
- SOLID ON - Modem normal indication, indication that self-tests passed and successful initialization, modem is ready to Auto-Answer. The On LED should stay LIT after answering and during a connection.
- SOLID OFF - Modem initialization failed, modem not operational, contact factory.

Ct: A red LED with two statuses:

- SOLID OFF - No carrier detected, modem is waiting for a connection.
- SOLID ON - Carrier has been detected; modem has a connection and is awaiting data. Data is present when Rx and Tx LEDs are FLASHING.

All LEDs are on during initial power-up, booting, of the EMC when the EMC's Status Display is a "**b**", but then should transition to just the **On** LED turned ON once the boot cycle is complete. If during power-up the Modem should fail any of the initialization all its LEDs are turned OFF, this is an indication that the modem is not operational.

A.7   EMC STATUS DISPLAYS FOR PMC-MODEM

The EMC will monitor the PMC-Modem operation and display any errors it detects as follows:

Flashing "**=**" then "**0**": Top PMC slot modem receiver over run error.
Flashing "**=**" then "**1**": Top PMC slot modem framing error.
Flashing "**=**" then "**2**": Top PMC slot modem parity error.
Flashing "**=**" then "**3**": Top PMC slot modem break mode error.
Flashing "**=**" then "**4**": Top PMC slot modem reserved.
Flashing "**=**" then "**5**": Top PMC slot modem inter-character timeout.

For a modem in the Bottom PMC slot replace the "**=**" character with the "**-**" character.

A.8   OPERATION OUTSIDE OF UNITED STATES

The PMC-Modem can be setup to operate outside of the United States by setting one of its available country codes.

It is important to verify which modem card is installed prior to setting the country code. The user will need to type the following AT command into the ASCII Terminal Emulator "ATI3" the data returned is the DSP that is used in the modem simply match it up to one of the charts below for the proper country codes. It is also possible to get the list of country codes that are in the modem by typing the AT command "AT+GCI=?". This only returns the codes not the countries that they belong to.

ATI3=P2109-v34

COUNTRY	CODE	COUNTRY	CODE	COUNTRY	CODE
Australia	09	Hong Kong	50	Norway	82
Austria	0A	Hungry	51	Philippines	89
Belgium	0F	India	53	Poland	8A
Brazil	16	Ireland	57	Portugal	8B
Bulgaria	1B	Israel	58	Russia	B8
Canada	20	Italy	59	Singapore	9C
China	26	Japan	00	South Africa	9F
Czech and Slovak Rep.	2E	Korea	61	Spain	A0
Denmark	31	Luxemburg	69	Sweden	A5
Finland	3C	Malaysia	6C	Switzerland	A6
France	3D	Mexico	73	Taiwan	FE
Germany	42	Netherlands	7B	United Kingdom	B4
Greece	46	New Zealand	7E	United States	B5

ATI3=CX81802-v34

COUNTRY	CODE	COUNTRY	CODE	COUNTRY	CODE
Argentina	07	Greece	FD	Netherlands	FD
Australia	09	ICELAND	FD	New Zealand	7E
Austria	FD	Ireland	FD	Norway	FD
Belgium	FD	Indonesia	99	Philippines	B5
Brazil	16	Israel	B5	Poland	99
Canada	B5	Italy	FD	Portugal	FD
Chile	99	Japan	00	Spain	FD
Cyprus	FD	Korea	B5	Sweden	FD
China	B5	Liechtenstein	FD	Switzerland	FD
Denmark	FD	Luxembourg	FD	Taiwan	FE
Estonia	FD	Malaysia	6C	Turkey	FD
France	FD	Mexico	B5	United Kingdom	FD
Germany	FD			United States	B5

If the desired country for installation doesn't appear in the table, it is recommended that the operator try a country within the same region. For example, if it is desired to install an EMC-2005 with a modem in South America, it's suggested to use Brazil's country code.

The country code may be set using the ASCII Terminal Mode (see Section A.5) over Port 1 (RS232) of the controller. The AT command when setting the country code, as seen from help screen (AT?), is AT+GCI=00 for Japan.

A.9   EMC MODEM PROGRAMMING INSTRUCTIONS

Using the EMC-2005's programming language it is possible to configure a PMC-Modem to operate as needed per an application.

It is intended that an application program could achieve the following:

- Set the modems country of installation setting.
- Retrieve the modems country of installation setting.

To avoid confusion the list of instructions and an explanation of there usage is maintain in the EDE, please refer to the EDE help for further information when programming the PMC-Modem.

APPENDIX B - ETHERNET PMC ETHERNET BOARD

B.1   ETHERNET OVERVIEW

The PMC-Ethernet card enables the application programmer to run the EDE software tools via Ethernet.

The PMC-Ethernet card creates an embedded XML document, which allows data to be transferred between a web application and the Emerald Motion Controller (EMC-2005). The application programmer can specify the exact nature of the resources available to the XML.

B.2   POWER REQUIREMENT

The PMC-Ethernet card requires an addition 4.8 watts maximum from the EMC power supply, therefore when sizing the 24VDC power supply for the EMC-2005 add .5 Amps of current for each Ethernet card installed.

B.3   WIRING

The PMC-Ethernet accepts a standard RJ-45 plug, therefore PIN-1 is Input Receive Data +, PIN-2 is Input Receive Data -, PIN-3 Output Transmit Data +, PIN-6 Output Transmit Data –, and pins 4,5,7, and 8 are not used.

B.4   PMC-ETHERNET LEDS

The PMC-Ethernet has four status LEDs; see description below:

Rx: A green LED that turns on when ever the PMC-Ethernet card is receiving data.

Tx: A yellow LED that turns on when ever the PMC-Ethernet card is transmitting data.

L: A green LED that turns on when there is a valid link exists.

100: A yellow LED that is on when the unit is set in 100 Mbits/s mode.

B.5   EDE SETUP FOR ETHERNET COMMUNICATION

The EDE is a PC Windows application developed by Industrial Indexing Systems to program the Emerald Motion Controller. The EDE can be configured to communicate remotely with the EMC via RS232, ETHERNET, or MODEM.

For remote access to the EMC-2005 with a PMC-Ethernet card, it is necessary to configure the EDE for communication via Ethernet. It is required that the PC running the EDE has an Ethernet connection.

B.5.1   SELECT ETHERNET FOR CONNECTION TYPE
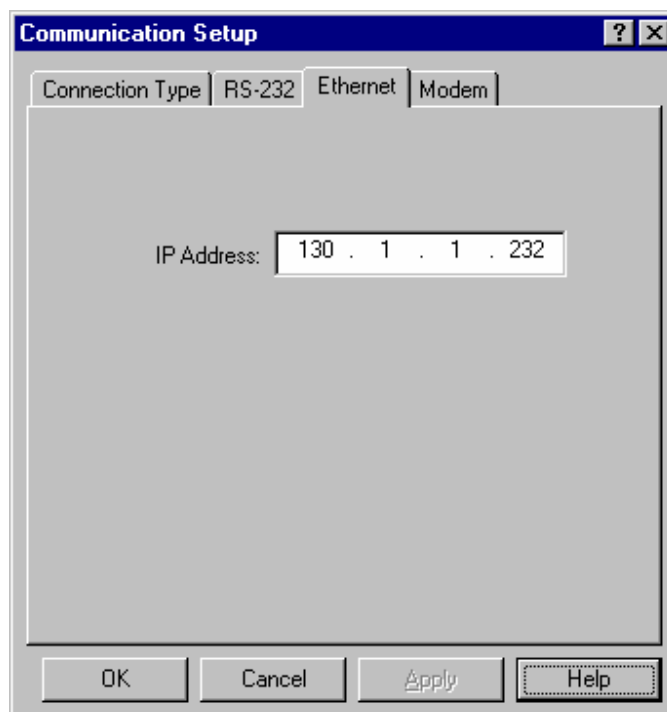
From the EDE toolbar go to **Setup** then select **Communication**, once the screen for Connection Type appears select **Ethernet** as shown below.

> # NOTE
> ## To be able to select communication, the EDE must not be currently connected.
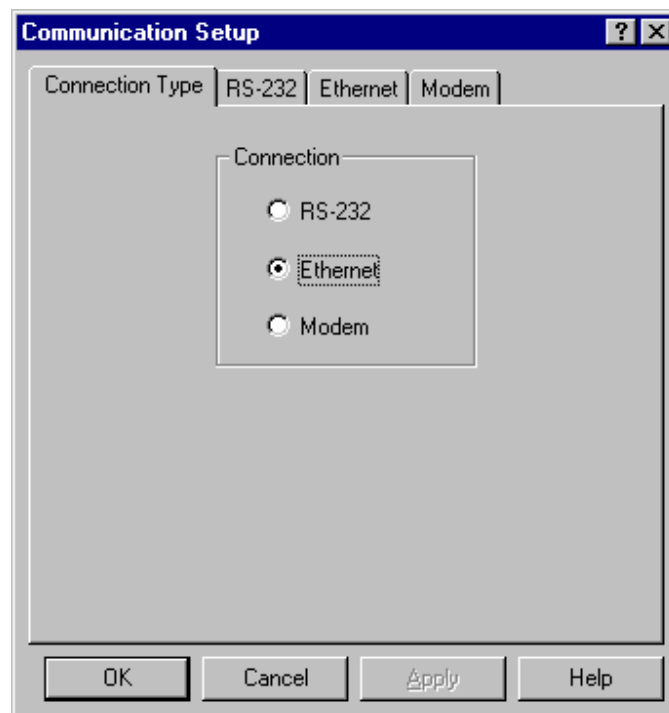
B.5.2 ETHERNET EDE CONFIGURATION SCREEN

After the Connection Type is set to Ethernet, select the Ethernet tab and the screen below will be displayed.
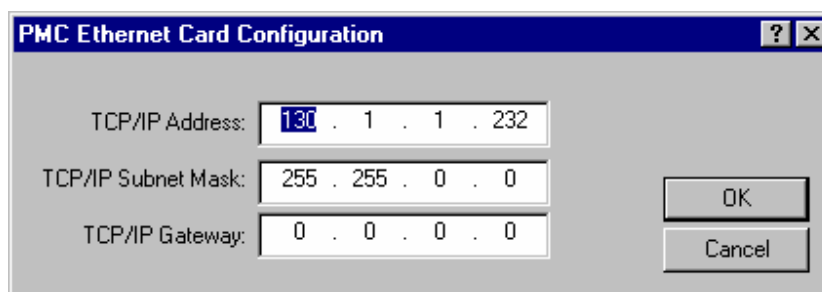
IP Address: This needs to be set to the IP Address of the Emerald controller that you desire to communicate to. After this value is entered, the EDE should be able to communicate over the Ethernet to the desired controller by selecting debug then connect from the EDE toolbar.

B.6 ETHERNET CARD SETUP

While you are connected using either RS-232 or Modem, from the EDE toolbar go to **Emerald Configuration** then select **PMC Cards** and then the Ethernet card from the desired slot. If Ethernet card is not displayed in the list, then the Emerald controller is not recognizing that the card is installed. After selected the desired Ethernet card the following window will be displayed:
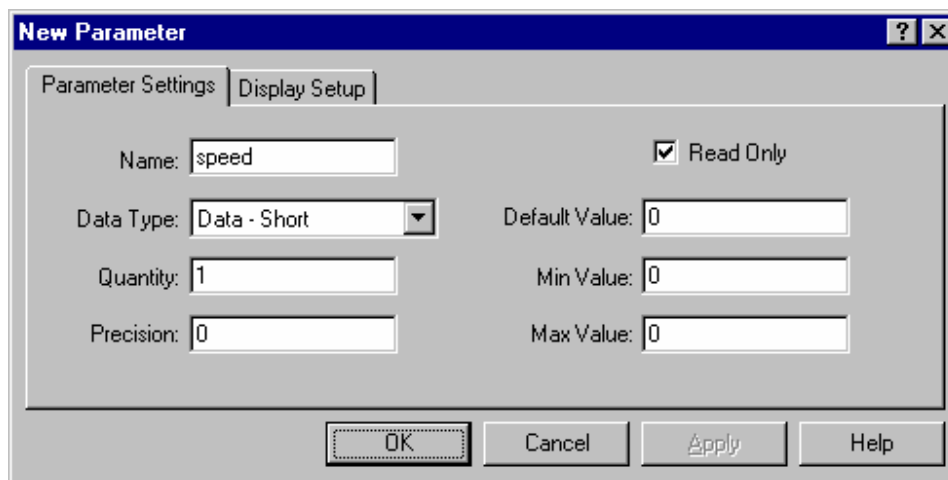
These settings can be modified to the desired settings while connected.

B.7 GLOBAL PARAMETERS

Using the EMC-2005's programming language it is possible to configure 128 Global parameters. These parameters are accessible through XML and controlled through the global parameter configuration.

Name: The name field must match a name used in the configuration section or program area of the selected data type.

Data Type: The type of data that is specified in the name field.
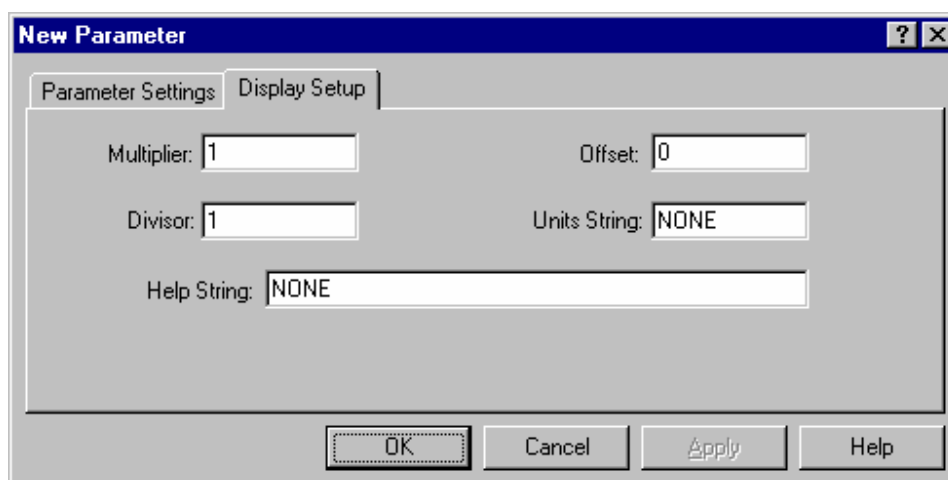
Quantity: This field is only used for data types that can be arrays. The number entered should be the same size or less then the size of the array.

Default Value: This value is currently not being used.

Read Only: If this box is checked the user cannot write any information to this parameter over a network connection.

Min Value: This value will limit the value written to this parameter.

Max Value: This value will limit the value written to this parameter.

B.7   GLOBAL PARAMETERS (cont'd)

The values on this tab of the global parameters can be used to modify the actual value for display purposes.

The following formulas should be used for data types short, long, text, short ext memory, and long ext memory by the web page developer to input a value to the controller and to display a value returned from the controller:

Displayed Value =   (Emerald value + offset) * multiplier
                               ----
                               divisor * (10 ^ precision)

NOTE: The value displayed should contain the number of decimal places of the entered precision.

Value written to Emerald =   value entered * divisor * (10 ^ precision)
                                  -- - offset
                                                   multiplier

NOTE: When the Emerald receives the value it is compared against the min and max limits. If a value is greater then the max limit the number is set equal to the max limit before it is written to the emerald memory. If a value is less then the min limit it is set equal to the min limit value before it is written to the emerald memory.

The unit's string is served up as part of the XML document.

The help string is not currently used.

B.8   DEFAULT WEB PAGE

The PMC-Ethernet card will serve up a home page as shown below:

File Name: Program Currently loaded in the Emerald Controller.

Firmware Rev: Revision of firmware currently in the Emerald Controller.

Ethernet Rev: Revision of firmware in the Ethernet card.

Mac ID: Ethernet Mac ID.

B.9   EMBEDDED XML DOCUMENT – READ ALL GLOBAL PARAMETERS

For web page developers the PMC-Ethernet card will serve up an embedded XML document. The document contains application specific data defined during application development using Global Parameter configuration.

To read all Global Parameters enter the home page
        address/GlobalParam.xml

The string "*GlobalParam.xml*" is case sensitive.

If a value has a quantity greater then 1, a comma will separate the values returned. If a value is displayed as <VALUE>123,34,12</VALUE> the quantity would be 3. Floating point numbers will be returned in an exponential format with 10 decimal places.
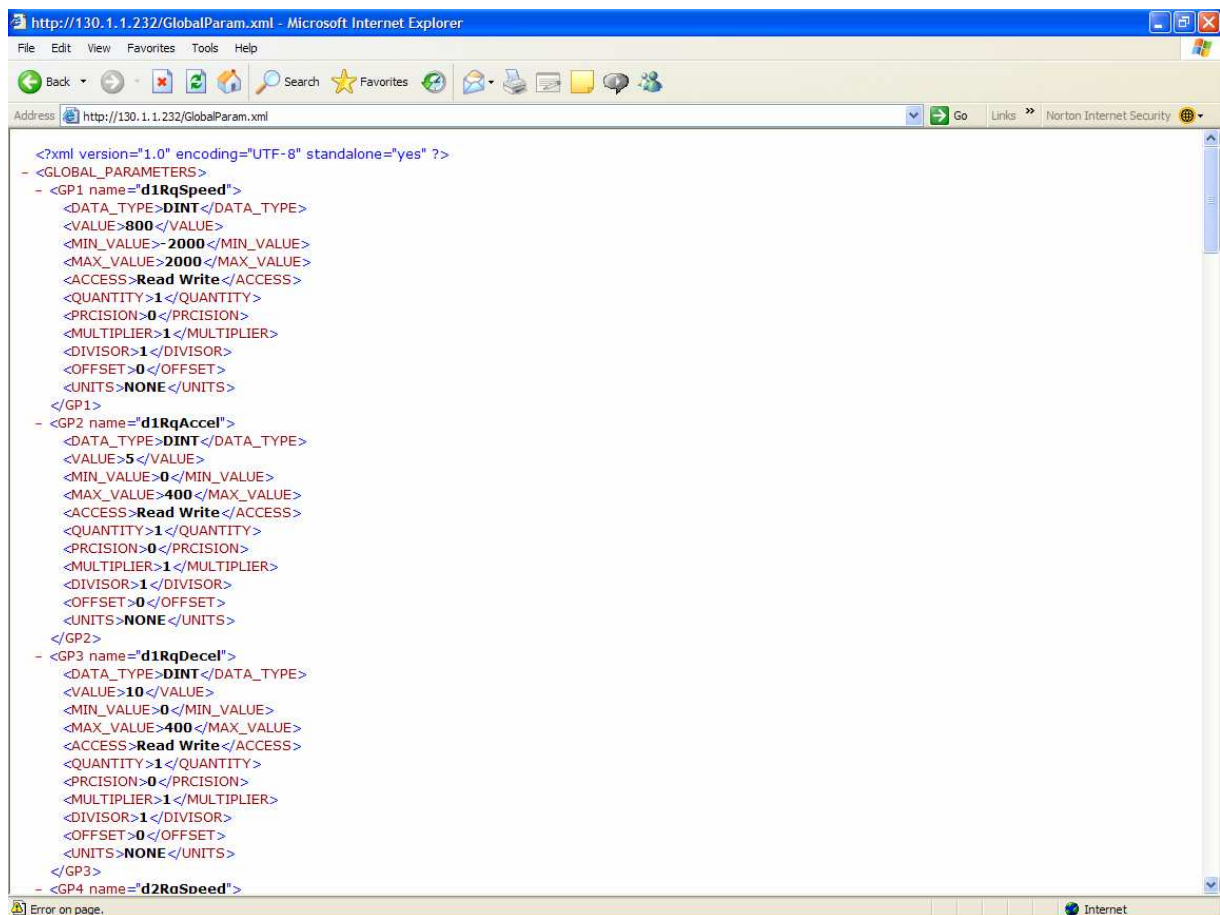
B.10 EMBEDDED XML DOCUMENT – READ A GLOBAL PARAMETER

To read a single Global Parameter enter the home page
   address/GlobalParam.xml?GLOBAL_PARAMETERS.GPXX
where XX is the desired parameter number.

The strings "***GlobalParam.xml***" and "***GLOBAL_PARAMETERS.GP***" are case sensitive.

If a value has a quantity greater then 1, then a comma will separate the values returned. If a value is displayed as <VALUE>123,34,12</VALUE> the quantity would be 3. Floating point numbers will be returned in an exponential format with 10 decimal places.
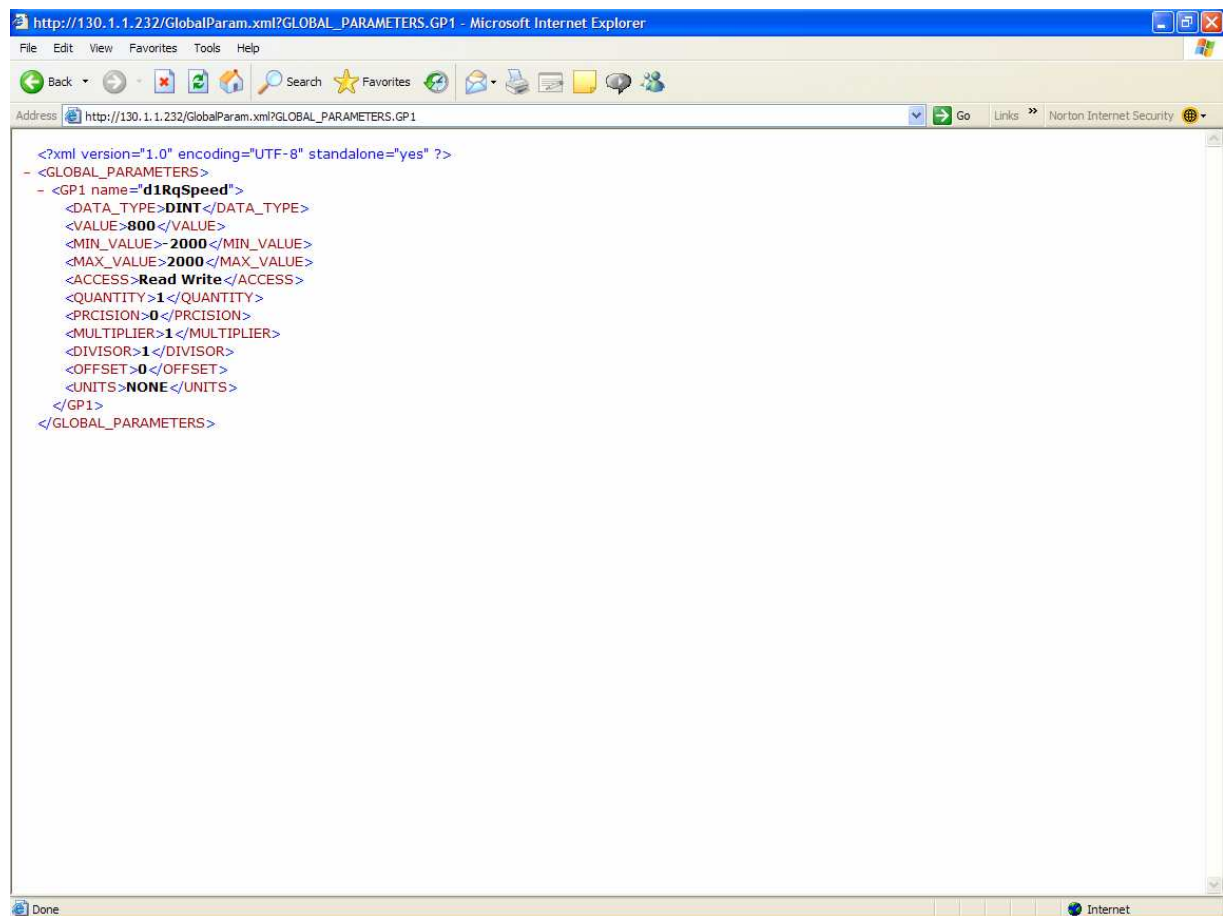
B.11 EMBEDDED XML DOCUMENT – READ A GLOBAL PARAMETER VALUE

To read a single Global Parameter Value enter the home page
        address/GlobalParam.xml?GLOBAL_PARAMETERS.GPXX.VALUE
where XX is the desired parameter number.

The strings "***GlobalParam.xml***" and "***GLOBAL_PARAMETERS.GPXX.VALUE***" are case sensitive.

If a value has a quantity greater then 1, then a comma will separate the values returned. If a value is displayed as <VALUE>123,34,12</VALUE> the quantity would be 3. Floating point numbers will be returned in an exponential format with 10 decimal places.
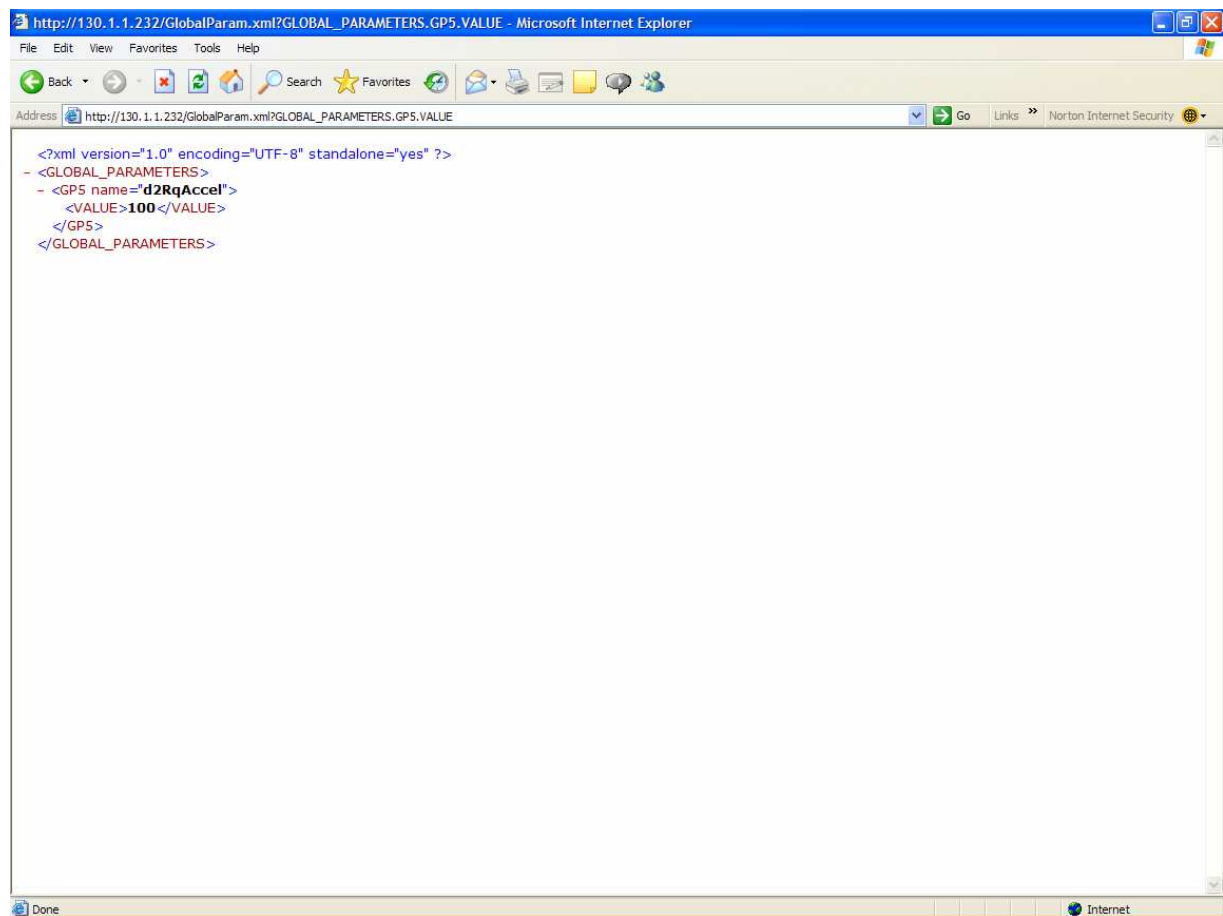
B.12 EMBEDDED XML DOCUMENT – WRITE A GLOBAL PARAMETER VALUE

To write a single Global Parameter value enter the home page
    address/GlobalParam.xml?GLOBAL_PARAMETERS.GPXX.VALUE=YYY
where XX is the desired parameter number and YYY is the desired input value. The page that will be displayed in the browser is the get a parameter value page.

To write several values to a Global Parameter with a quantity greater than 1, enter the home page
    address/GlobalParam.xml?GLOBAL_PARAMETERS.GPXX.VALUE=YYY,ZZZ
where XX is the desired parameter, YYY is the first value, and ZZZ is the second value.

The strings "*GlobalParam.xml*' and "*GLOBAL_PARAMETERS.GPXX.VALUE*" are case sensitive.

If the Global Parameter is a flag, setting the value to 0 will turn the flag OFF while setting it to one will turn the flag ON.

In order to write a value to the controller memory, the Global Parameter *must not be read only*. Before a value is written, it is compared against the min and max parameter values. If the value is greater then the max value, then the max value will be written. If the value is less then the min value, then the min value will be written to memory.
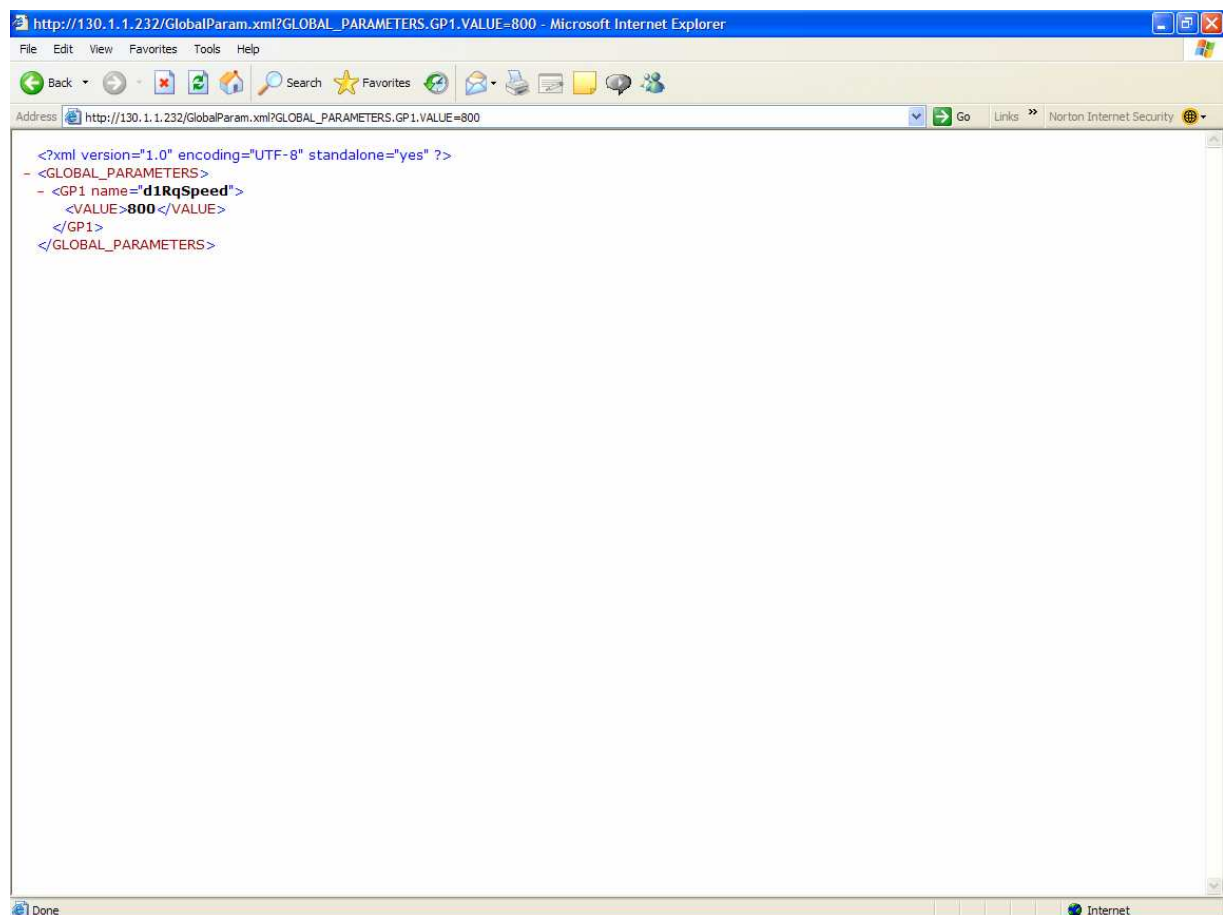
APPENDIX C - MASTER RESOLVER PMC OPTION BOARD

C.1   MASTER RESOLVER OVERVIEW

The PMC-Resolver card enables the application programmer to connect a resolver to the Emerald Controller. The attached resolver can then be configured as a Master Source in the application via the EDE software tools.

C.2   POWER REQUIREMENT

The PMC-Resolver card requires an additional 2.5 watts maximum from the EMC power supply, therefore when sizing the 24VDC power supply for the EMC-2005 add .5 Amps of current for each PMC-Resolver Card installed.

C.3   WIRING

Error! No topic specified.

Figure C.1 - PMC-Resolver Card Wiring

C.4   PMC-RESOLVER LEDS

The PMC-Resolver card has two status LEDs:

On: A green LED that turns on at power up and remains on if the PMC-Resolver card is initialized correctly by the EMC-2005.

Flt: A red LED that turns on at power up. This LED will go out after the EMC-2005 initializes the PMC-Resolver card and no fault exists on the card. If the red LED is still on then check if resolver is connected correctly and the bit resolution is configured appropriately for the application.

C.5   PMC-RESOLVER CARD SETUP

To utilize the resolver position feedback from a PMC-Resolver card in an application, the card must be configured as a Master Position Source in the application.

C.5.1   CONFIGURING A RESOLVER AS A MASTER POSITION SOURCE

To configure the PMC-Resolver card as a source first determine which PMC option slot location the card is installed (See **Section 2, Figure 2.1**). From the Emerald Configuration tree select "SOURCES". A Source List dialog box will appear. From the Source list dialog box select "Add" button to add a source. The Add Source Dialog box will appear. In the Add Source dialog box name your source and select "Resolver PMC Slot 1" or "Resolver PMC Slot 2" as the description.
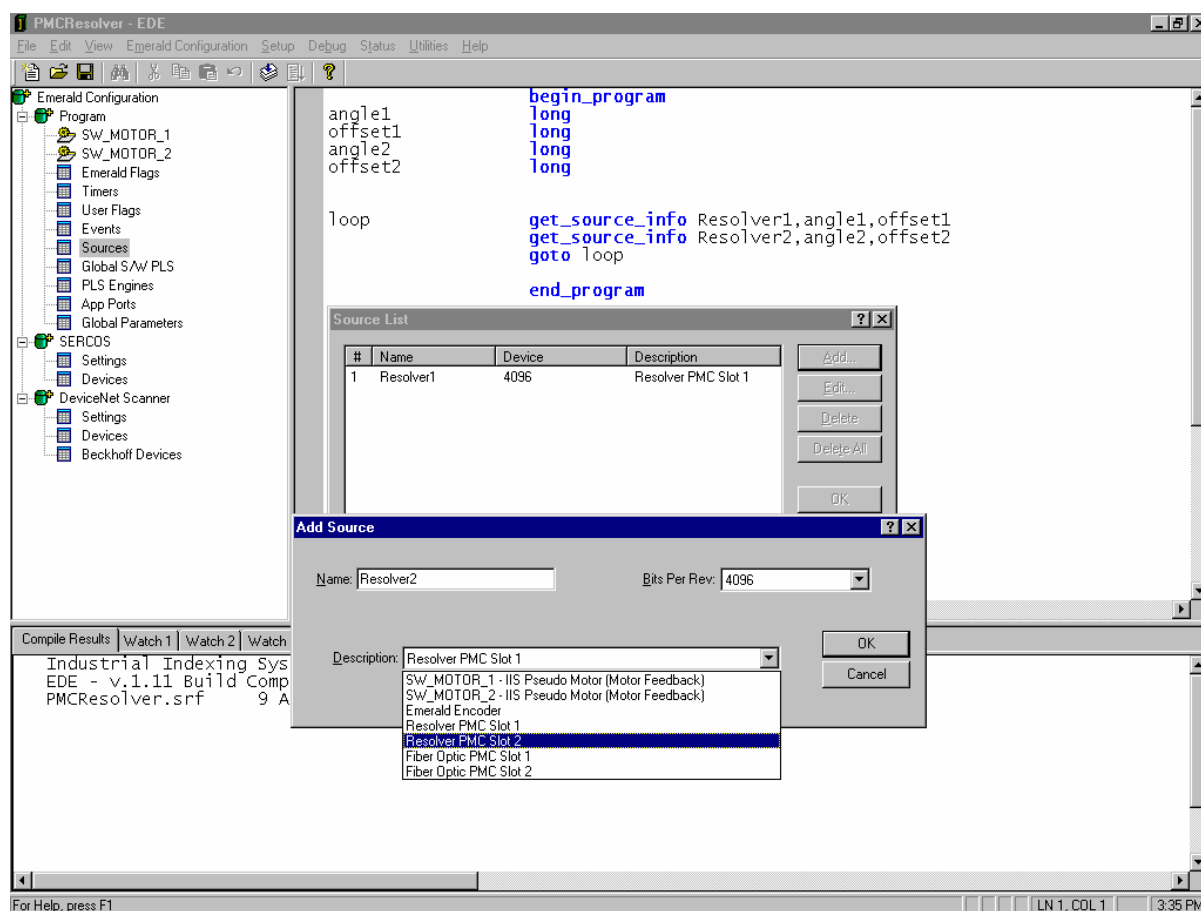
You will then need to set the bit resolution of the position feedback in bits per rev. The table below defines the maximum shaft speed the resolver for a given bit resolution. A shaft speed above the Maximum for a given resolution will cause a fault on the card and may return errors in the resolver position.

Resolution (Bit)	Bits Per Revolution	Max Resolver Shaft Speed	Description
10	1024	14400	10 Bit Mode
12	4096	3600	12 Bit Mode
14	16384	900	14 Bit Mode
16	65536	225	16 Bit Mode

APPENDIX D - FIBER OPTIC MASTER PMC OPTION BOARD

D.1   FIBER OPTIC MASTER OVERVIEW

The PMC-FIBER OPTIC MASTER (PMC-FOM herein) card enables the application programmer to connect an Industrial Indexing Systems Fiber Optic Master Signal to the Emerald Controller. The Fiber Optic Master can then be configured as a Master Source in the application via the EDE software tools.

More than one Emerald can easily receive the same master signal from an encoder or resolver using the PMC-FOM option boards. The PMC-FOM(s) allow a fiber-optic chain to be utilized, accomplished by connecting one Emerald's PMC-FOM Transmitter to the next Emerald's PMC-FOM Receiver with fiber-optic cables.

Error! No topic specified.

Figure D.1 - Fiber Optic Master Overview

D.2   SPECIFICATIONS

D.2.1   POWER REQUIREMENTS

The PMC-FOM card requires an additional 2.5 watts maximum from the EMC power supply, therefore when sizing the 24VDC power supply for the EMC-2005 add .5 Amps of current for each PMC-FOM Card installed.

D.2.2   OPTICAL MASTER PROPOGATION

Master Signal Reception to Master Signal Transmission to be within 200 nanoseconds.

D.2.3   MASTER POSITION UPDATE

Fiber Optic Master Signal is conditioned internally by the EMC-2005 at the SERCOS cycle time. The SERCOS cycle time is setup within the SERCOS settings as shown below:
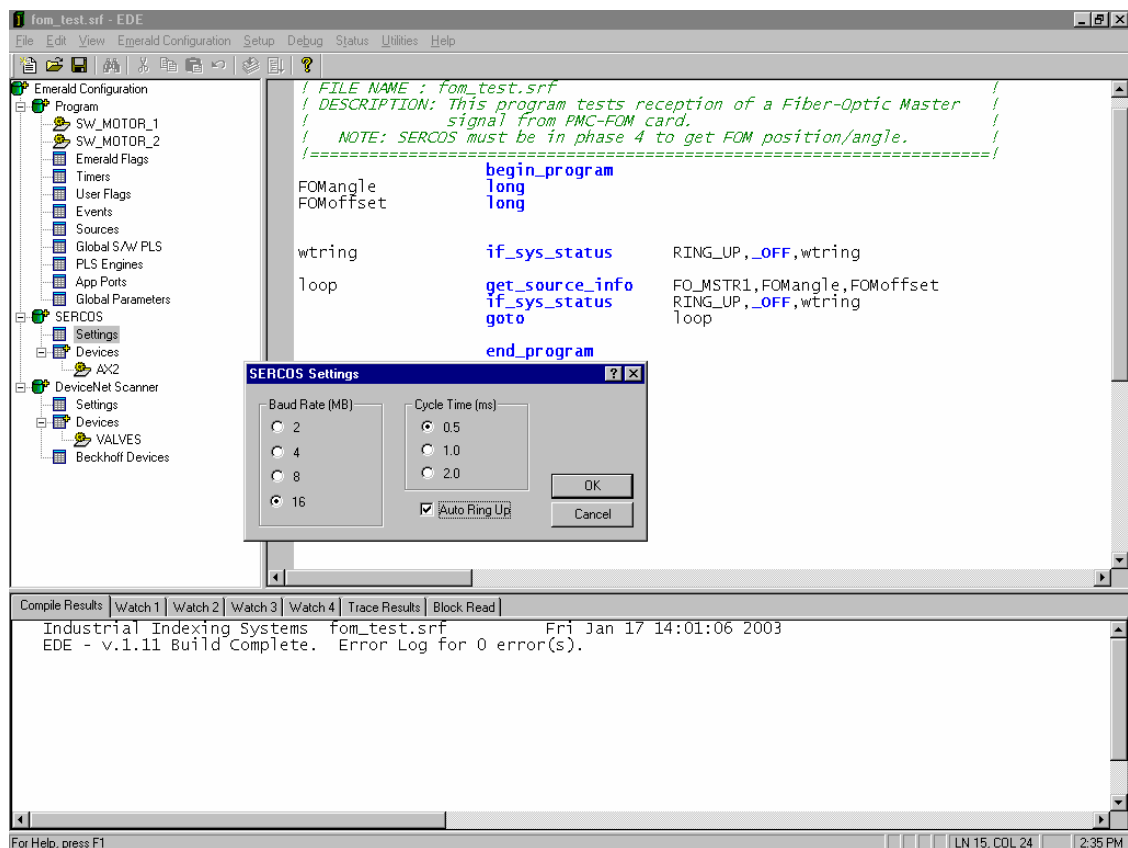
D.3   DESCRIPTION

Error! No topic specified.

Figure D.2 - Fiber Optic Master Description

D.4   PMC-FOM LEDS

The PMC-FOM card has two status LEDs:

Green

Red
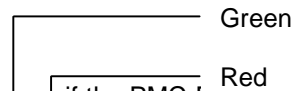
A green LED that turns on at power up and remains on if the PMC-FOM card is initialized correctly by the EMC-2005. Once the EMC-2005 controller has successfully brought up its SERCOS control ring and the Fiber-optic signal from the PMC-FOM has no signal the ON green LED will flash.

A red LED that turns on at power up and goes out after the EMC-2005 Transmitter (Gray) FOM card and no fault exists on the card. If the red LED is on with no Fiber-optic cable connected to the receiver the EMC-2005 was not able to initialize the card. If the red LED is on Receiver (Blue) ber-optic signal, then check for incorrect transmission rate settings at the Fiber-Optic Master source.

D.5   PMC-FOM CARD SETUP

To utilize the Fiber-Optic position feedback from a PMC-FOM card in an application, the card must be configured as a Master Position Source in the application.

D.5.1   CONFIGURING A PMC-FOM AS A MASTER POSITION SOURCE

To configure the PMC-FOM card as a source first determine which PMC option slot location the card is installed (See **Section 2, Figure 2.1**). From the Emerald Configuration tree select "SOURCES". A Source List dialog box will appear. From the Source list dialog box select "Add" button to add a source. The Add Source Dialog box will appear. In the Add Source dialog box name your source and select "Fiber Optic PMC Slot 1" or "Fiber Optic PMC Slot 2" as the description.
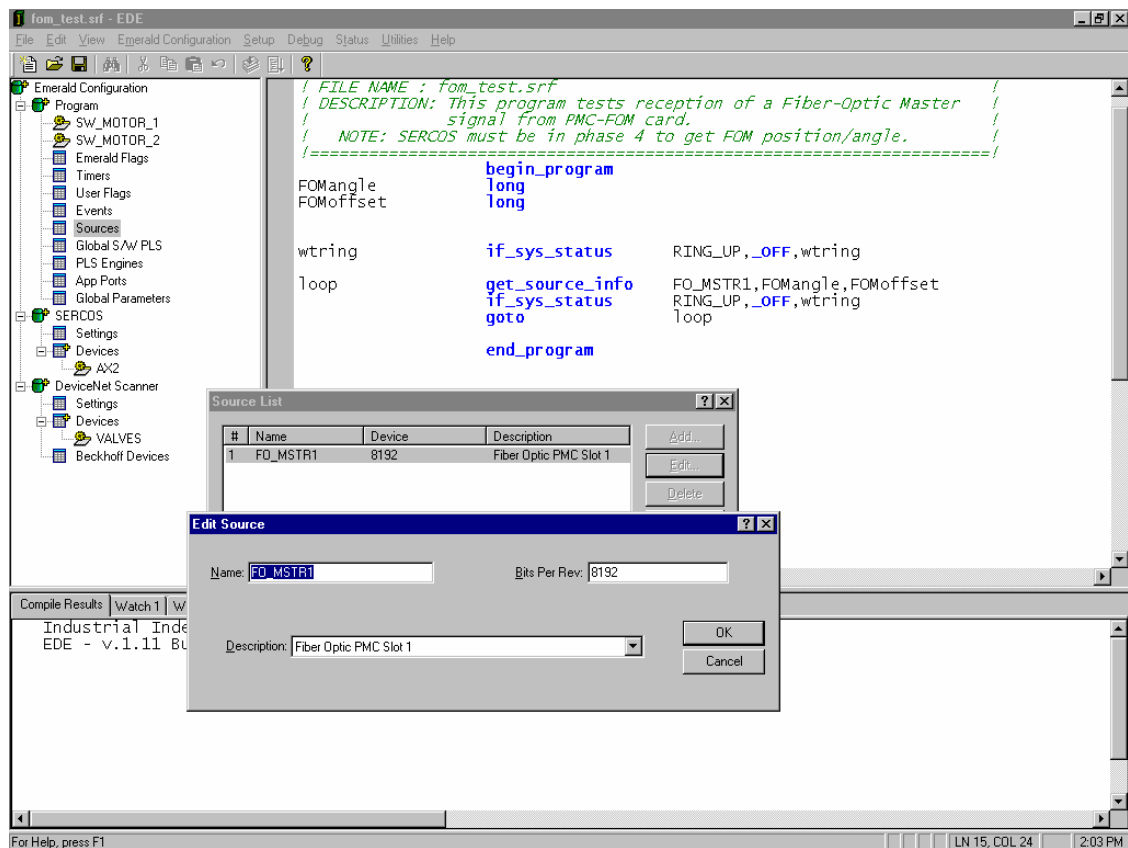
You will then need to set the bit resolution of the position feedback in bits per rev expected from master source transducer and IIS Fiber-Optic converter, typically an EFC or RFC connected to a encoder or resolver respectively.

APPENDIX E - SMARTMEDIA MEMORY PMC OPTION BOARD

E.1   SMARTMEDIA MEMORY OVERVIEW

The optional PMC-SmartMedia board facilitates EMC-2005 Application Program and Operating System Firmware uploads from power-up, using readily available "SmartMedia Memory Cards" (herein referred to as just SmartMedia). SmartMedia can be obtained from local retailers in the business of supplying consumer electronic and computer equipment.

E.2   SPECIFICATIONS

E.2.1   POWER REQUIREMENTS

The optional PMC-SmartMedia board requires an additional 2.5 watts maximum from the EMC power supply, therefore when sizing the 24VDC power supply for the EMC-2005 add .5 Amps of current.

E.2.2   SMARTMEDIA SUPPORT

All of the following sizes are supported from any manufacture:

1MegaByte	16MegaByte
2MegaByte	32MegaByte
4Megabyte	64MegaByte
8MegaByte	128MegaByte

E.3   PMC-SMARTMEDIA DESCRIPTION

When the PMC-SmartMedia board is installed in an Emerald Controller the SmartMedia insertion slot and two LEDS are visible. The LEDs help to determine functional status of the SmartMedia option board and memory. The SmartMedia are to be inserted into the socket until only about 1/8" of the card is showing outside the socket.

Error! No topic specified.

Figure E.1 - PMC-SmartMedia Description

E.4   PMC-SMARTMEDIA LEDS

The PMC-SmartMedia option board has two status LEDs marked with **B** and **F** meaning busy and fault respectively. Upon power-up of the EMC-2005 both LEDS will be ON until the PMC-SmartMedia board is properly initialized, then both the **B** and **F** led should go out. If the PMC-SmartMedia board has malfunctioned during this process the red **F**ault LED will stay ON.

NOTE: In The Event Of A Power-Up Fault The Green Busy Led May Also Stay On With The Red Fault Led.

The following constitutes the remaining statuses from the LEDs:

B (Busy green LED):

> ON - Indicates that the SmartMedia socket is active, <u>**don't**</u> disturb the memory card.
> OFF - Indicates socket is idle and SmartMedia may be removed or inserted.

F (Fault red LED):

> ON - SmartMedia is possibly damaged or of incorrect format. Remove the memory and cycle power to the EMC-2005 to see if the power-up initialization is successful.
> OFF - No faults.

E.5   PMC-SMARTMEDIA OPERATION

The SmartMedia may be inserted or removed with or without the Emerald controller having power applied.

IMPORTANT

Avoid removing SmartMedia memory cards when the Busy LED is on, in that this could damage the SmartMedia memory card.

The PMC-SmartMedia board will search the root directory of an inserted SmartMedia to find an application program and or EMC-2005 Operating System Firmware to upload the controller with, files of the extensions *.exf and *.abs respectively. If only the Application Program is desired to be uploaded than the *.abs file should not be in the root directory of the SmartMedia only the *.exf file. Likewise if its desired that only the Operating System Firmware be uploaded then the *.exf file should not reside in the root directory of the SmartMedia only the *.abs file. Its important to note that only one *.exf and one *.abs file may reside in the root directory of the SmartMedia for proper operation. It is okay for a directory tree and other files of differing extensions, other than *.exf or *.abs, too reside in the root directory without effecting PMC-SmartMedia board operation.

Files are to be copied to the SmartMedia using a PC with SmartMedia read/write support.

APPENDIX F - EMBEDDED PC PMC OPTION BOARD

F.1   EMBEDDED PC OVERVIEW

The Embedded PC option board for the Emerald Motion Controller (EMC-2005) has been developed around the Geode SC2200 integrated processor.

General Features

- 32-bit x86 processor with MMX instruction set support running at 300 MHz
- 256 Mbyte SDRAM
- 1 VGA Port
- 3 USB ports, OHCI version 1.0 compliant
- 1 10/100 Mbit Ethernet port
- 1 Isolated 3-wire serial port
- 20 Gbyte Hard Drive

The Embedded PC interfaces to the EMC-2005 over the PCI bus. Windows drivers are available to interface a Visual Basic application to the EMC-2005. See IIS Document IB-20B003 for details on the Windows driver.

F.2   POWER REQUIREMENT

The Embedded PC option board requires an additional 12 watts maximum from the EMC power supply, therefore when sizing the 24VDC power supply for the EMC-2005 be a little generous and add about .5 Amps of current.

F.3   WIRING

Most of the connections to the Embedded PC use standard PC connectors.

F.3.1   ETHERNET

The Ethernet Port on the Embedded PC accepts a standard RJ-45 plug.

F.3.2   USB

The three USB ports on the Embedded PC are standard USB Type-A sockets.

F.3.3 SERIAL PORT

The serial port on the Embedded PC accepts a standard RJ-11 phone plug. The table below lists the pin out for the connector.

RJ-11 Plug (On the cable)	Function
1	NC
2	NC
3	Tx
4	Ground
5	Rx
6	NC

F.3.4 VGA

To connect a VGA monitor to the Embedded PC IIS adapter cable C-763000.5 is needed.

F.4 LEDS

There are four LEDs on the Embedded PC to indicate Ethernet and Hard Drive status.

100 - Green LED indicating a 100Mbit Ethernet Link
10 - Green LED indicating a 10Mbit Ethernet Link
ACT - Amber LED indicating Ethernet Activity
HDD - Red LED indicating Hard Drive Activity

F.5 USB PORTS

As mentioned above there are three USB ports on the Embedded PC. Any USB device that is supported by the operating system can be connected to any of the three ports. Each port is capable of supplying 500mA to its connected devices.

The BIOS for the Embedded PC has two USB features that aid in loading an operating system and performing non-Windows functions. First, legacy USB keyboard and mouse support is provided, allowing a USB keyboard and mouse to function just like a standard keyboard or mouse. Secondly, the BIOS allow booting from a USB Mass Storage Device for operating system installation.

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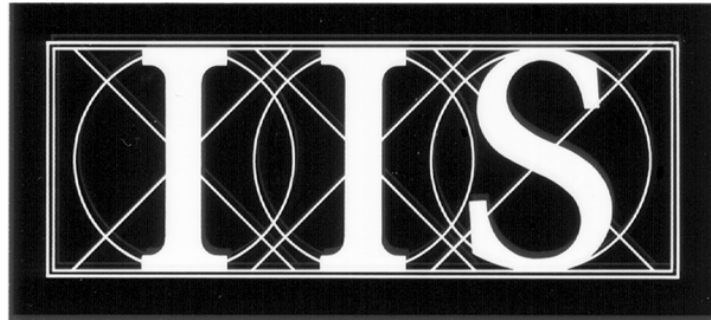
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TABLE OF CONTENTS

SECTION 5 - CONNECTIONS / WIRING

SECTION 6 - CONFIGURATION & PROGRAMMING

SECTION 7 - FAULT CODES / STATUS

APPENDIX A - MOTORS, DRIVES, CABLES AND ACCESSORIES

APPENDIX B - ESD-IO16 I/O EXPANDER

APPENDIX C - EMC INSTALLATION GUIDELINES FOR EMERALD SERIES MOTORS AND DRIVERS

LIST OF ILLUSTRATIONS

APPENDIX B - ESD-IO16 I/O EXPANDER

APPENDIX C - EMC INSTALLATION GUIDELINES FOR EMERALD SERIES MOTORS AND DRIVERS

INTRODUCTION

Thank you for selecting ABM INTERNATIONALS' Emerald Series products. You join many other companies around the world in your choice of these powerful, flexible motion control products.

The Emerald Driver can be configured by the user to operate as a Single Axis Driver /Controller combination (CONTROLLER Mode) or as a Slave Device connected to a SERCOS Interface[TM1] Master controller (SERCOS Mode).

The design of the Emerald Drivers combine the latest in all-digital electronic design, SMT circuit board construction and clever engineering to deliver high performance, advanced features and reasonable cost. Compact, high power density motors provide low rotor inertia, making them the logical choice for positioning and indexing applications.

Emerald Drivers have a wide array of features, including a powerful embedded high speed 32-bit 150 MHz Digital Signal Processor, high visibility 7-segment LED Status display, Support for Analog and Digital I/0, programmable limit switches, S-curve profiling, fault history log and many more. Dozens of operational parameters can be programmed. Utilizing Emerald's Windows based PC software tools, allows quick set-up for a full range of diagnostics and PC oscilloscope functions to display speed and current waveforms and most any other diagnostic data the user may need.

Reference materials for the Emerald Series of Motion Control Systems:

IB-20B004	EMC-2005 Emerald Multi-Axis Controller
HPB Catalog	Additional Motor Specifications
EDE	Emerald Software Development Tools
EDrive	Diagnostic Tools
SMA2000	Servo Mechanical Analysis

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[1] SERCOS Interface is a trademark of Interest Groups SERCOS

SECTION 1 - INSTALLATION AND SAFETY

Definition - Within this document will be the phrase "MAIN BUS POWER SUPPLY". This phrase is to define the AC power as 220V AC +/-20% or 440V AC +/-20%, see **Section 4.1.2** for further details.

WHEN INSTALLING AN EMERALD SERVO DRIVE FOR THE FIRST TIME OR REPLACING AN EXISTING DRIVE ALWAYS FOLLOW BOTH SECTIONS 1.1.4 AND 1.2.

1.1   INSTALLING THE EMERALD SERVO DRIVE

When installing the Emerald servo drive into an enclosure you should follow the guidelines below. First consider what regulatory directives you should follow, such as UL, TUV, CE or other regulatory agencies, see **Sections 1.1.1 and 1.1.2**. Then select the electrical enclosure best suited for the system components, power dissipation in the electrical enclosure, and regulatory approvals. If you need any assistance with the installation of the Emerald servo drive or would like a quote for a full enclosure assembly, please contact ABM INTERNATIONAL INC. When laying out the wiring of the electrical enclosure, be sure to route the wiring as explained in **1.1.3** and to keep in mind regulatory requirements. Before applying power to the system, follow all checks listed in **Section 1.1.4** and then follow the first time system power procedure in **Section 1.2**.

If you are replacing a drive in an existing electrical enclosure with an Emerald servo drive, make sure you read through and follow all precautions and wiring requirements for the Emerald servo drive. Always follow the first time system power up procedure after the installation of a new drive, even if the Emerald drive you just installed was replacing an existing Emerald servo drive, see **Section 1.2.1**.

THE EMERALD SERVO DRIVE IS A HIGH LEAKAGE CURRENT DEVICE. MAKE SURE THAT THE EARTH GROUND IS ATTACHED PROPERLY AS DESCRIBED IN SECTION 5.1.

1.1.1   REGULATORY AGENCY INSTALLATIONS

To comply with the agency approvals for electrical enclosure installation, you must follow all wiring guidelines, install proper safety devices, and follow all labeling requirements for the regulatory agency of your choice. See **Section 1.3.1** for more details. For CE applications you must add noise suppression components as described in **Section 1.3.1**.

1.1.2   CHOOSING AN ELECTRICAL ENCLOSURE

If your installation requires CE approval, you must have a NEMA12 or IEC6 electrical enclosure with RF shielded gasketing. Make sure the electrical enclosure you choose has the appropriate agency approvals for use. Using the information provided in **Sections 4.1.2, 5.3.1**, and the average running motor(s) current, find the power loss of the drive system. Add the power loss of the Emerald servo drive system with all other components to come up with a full system power loss. Then using the information provided by the electrical enclosure manufacturer, derive the ambient temperature rise inside the electrical enclosure. Determine if you will need a cooling system for the electrical enclosure by keeping the temperature inside the electrical enclosure below 55 Degrees C in the final installation environment. If a cooling system is required be sure to use air filtration devices to keep dust, water vapors, or other contaminates from accumulating in the electrical enclosure.

1.1.3   EMERALD SERVO DRIVE AND REGEN RESISTOR MOUNTING

⚠️ **WHEN DRILLING, TAPPING, CUTTING, WELDING, OR OTHER ACTIVITY THAT MAY CAUSE METAL DEBRIS, THE EMERALD SERVO DRIVE SHALL BE REMOVED FROM THE ELECTRICAL ENCLOSURE. THE EMERALD SERVO DRIVE IS OF OPEN TYPE CONSTRUCTION AND FOREIGN MATTER COULD LODGE INTO THE CIRCUITRY OF THE UNIT.**

When mounting the Emerald servo drive in the electrical enclosure, always mount the drive upright in the horizontal position. Always leave at least 1 inch of space between the Emerald servo drive and any other component. Tighten all mounting screws to the specified mounting torque using proper grounding methods to tie the Emerald servo drive case to earth ground. When routing the wiring in the electrical enclosure, be sure to follow proper codes, bending radii, wire gauge and separation of voltages.

When installing a Regen resistor, mount it in a location where there is free access to airflow and no flammable material is near the Regen resistor. Never mount the Regen resistor closer than 6 inches from any other device. Doing so can cause undo temperature rise to other components and impede airflow to the Regen resistor.

1.1.4   FINAL CHECKS PRIOR TO APPLYING POWER

⚠️ **FAILURE TO COMPLY WITH ANY OF THE PROCEEDING INFORMATION MAY CAUSE INJURY OR DEATH TO PERSONNEL OR CAUSE DAMAGE TO THE EQUIPMENT.**

1) Verify you have fuses or circuit breakers in line with each Emerald servo drive in accordance with **Section 5.2.1**. Also verify if the wiring of the contactor, if one is installed, with the information in **Section 5.2.2**.

2) Verify the 24V power supply connected to the Emerald servo drive is a class 2 power supply capable of delivering not more than 10A continuous and is used for powering Emerald servo drives, Emerald controllers, and ESD-I/O16 control power only. Any I/O that drives relays, contactors, or high current devices should be powered by a separate 24V power supply. Verify the 24V power supply connected to the Emerald servo drive is connected as shown in **Section 5, Figure 5.1**.

1.1.4 FINAL CHECKS PRIOR TO APPLYING POWER (cont'd)

3) Verify the wiring to the Emerald servo drive main bus power input connector meets **Section 5, Figure 5.1** and the correct voltages and wire gauges are used. Verify the Emerald servo drive main bus power supply is wired in accordance with the information in **Sections 4.1.2 and 5.2.3**. If a transformer is used, verify it meets the information described in **Section 5.2.4**. It is recommended to use line filters of type SHAFFNER FN258-55-07 or equivalent.

> **CAUTION - LINE FILTERS HAVE HIGH LEAKAGE CURRENTS. THEY MUST BE PROPERLY CONNECTED TO EARTH GROUND.**
>
> **CAUTION - FIRE COULD RESULT IF THE REGEN RESISTOR IS MOUNTED NEAR ANY FLAMMABLE MATERIAL.**

4) If an external Regen resistor is used, verify it is mounted away from any flammable material and is wired to the Emerald servo drive in accordance with **Section 5, Figure 5.1**. Also verify the Regen resistor is mounted at least 6 inches away from any other components as described in **Section 1.1.3**.

5) Verify wiring of the electrical enclosure maintains separation of voltages. This will keep EMI from entering on to a low voltage cable. If EMI is present on a low voltage cable, it could cause intermittent operation of the Emerald servo drive.

> **NEVER DISABLE ANY SAFETY DEVICE IN THE SYSTEM FOR ANY REASON. INDUSTRIAL INDEXING SYSTEMS INC. CANNOT BE RESPONSIBLE FOR ANY PRACTICES NOT COMPLYING WITH THIS MANUAL, SAFETY PROCEDURES OUTLINED BY A REGULATORY AGENCY, AND/OR YOUR COMPANIES SAFETY GUIDE LINES AND PROCEDURES.**

6) Verify all ESTOPS and protective devices are installed and properly wired both inside and outside of the electrical enclosure.

> **SOME APPLICATIONS MAY REQUIRE A CONTACTOR BETWEEN THE EMERALD SERVO DRIVE AND THE MOTOR. TO DETERMINE IF THIS IS SO, CONTACT YOUR LOCAL SAFETY REGULATORY AGENCY. IF THIS CONTACTOR IS UTILIZED, PRECAUTIONS MUST BE MADE TO ASSURE THAT THE DRIVE IS DISABLED BEFORE OPENING THE CONTACTOR OR THE MOTOR INDUCTANCE WILL CAUSE HIGH VOLTAGE ARCING IN THE CONTACTOR POSSIBLY DAMAGING THE CONTACTOR AND THE EMERALD SERVO DRIVE.**

7) All cables with internal shield shall have the shield connected to the electrical enclosure case. The electrical enclosure case shall be tied to earth ground. To tie the cables shield to the electrical enclosure, a small portion of the cable jacket is removed which exposes the shield braid. The shield braid shall be clamped to a conductive harness, which is then properly secured to the electrical enclosure.

1.2   POWERING UP AN EMERALD SERVO DRIVE FOR THE FIRST TIME

DANGER - HIGH VOLTAGE EXISTS WITHIN THE DRIVE AND ON THE REGEN RESISTOR CONNECTOR FOR 5 MINUTES AFTER AC POWER IS REMOVED.

CAUTION - NEVER APPLY MAIN BUS POWER SUPPLY UNTIL ALL CHECKS FOR PROGRAM AND ALARM CONDITIONS HAVE BEEN MADE.

1.2.1   STEPS TO FIRST TIME POWER UP

CAUTION - Whether you are using an Emerald controller or have the Emerald servo drive in controller mode, NEVER assume the controller has no program loaded into it. If the controller has an unknown program loaded and the MAIN BUS POWER SUPPLY is applied to the system, the motor could move in an unexpected manner.

1)   Check switch settings on the Emerald servo drive. See **Section 6.1** for more details.

2)   Apply 24V power to the system and connect a computer to the Emerald controller or the Emerald servo drive in controller mode with the EDE tools. Verify the program loaded is correct for your system. If not, down load the correct program now. If your Emerald controller has a boot loader option card installed, you may use the memory card preloaded with the appropriate program to load the controller. See **IB-20B004** for more details.

3)   EMERALD SERVO DRIVE IN CONTROLLER MODE.
     Verify the Emerald servo drive has an "A" in the status display and is not flashing any fault codes. If a fault code is flashing on the Emerald servo drive, see **Section 7** of this manual. DO NOT CONTINUE THE POWER UP PROCEDURE IF THE EMERALD SERVO DRIVE IS SHOWING A FAULT CODE.

4)   EMERALD SERVO DRIVES WITH AN EMERALD CONTROLLER.
     Verify the Emerald controller has an "A" in the status display. Also verify the Sercos status LED's on the Emerald controller is indicating "Phase 4" and is solid on. On the Emerald servo drive, verify the status display is showing a "4" and is not flashing any other codes. If a fault code is flashing on the Emerald servo drive, see **Section 7** of this manual.
           DO NOT CONTINUE THE POWER UP PROCEDURE IF THE EMERALD SERVO DRIVE OR EMERALD CONTROLLER IS SHOWING A FAULT CODE.

5)   If you removed any fuses earlier to disable the MAIN BUS POWER SUPPLY source, then remove all power from the electrical enclosure and replace the fuses now. Then turn on any ESTOPS or circuit breakers to enable the MAIN BUS POWER SUPPLY to the Emerald servo drive. Verify the amber bus indicator on the Emerald servo drive is lit. If the amber bus indicator is not lit, check to see if one or more safety criteria are not met. If all safety requirements have been met and the amber bus indicator is still not lit, then contact INDUSTRIAL INDEXING SYSTEMS INC.

6)   You are now ready to use you Emerald servo drive.

1.3   BUILDING AN ELECTRICAL ENCLOSURE FOR AGENCY APPROVAL

1.3.1   BUILDING AN ELECTRICAL ENCLOSURE FOR CE

For the electrical enclosure to meet CE specifications there are a few additions that must be made to the electrical enclosure bill of material.

1)   The electrical enclosure must be of type NEMA12 or IP6X and have RF shielded gasketing.

2)   A line filter of type SHAFFNER FN258-55-07 or equivalent must be installed on the MAIN BUS POWER SUPPLY inlet.

3)   A main line transformer must be installed supplying the electrical enclosure with MAIN BUS POWER SUPPLY.

4)   A ferrite core must be placed around the wires of U, V, and W of the motor cable at the Emerald servo drive side of part number 0431176451 from FAIR-RITE corporation or equivalent.

5)   The motor cable must be a shielded cable of part number EAC-XYZMMM or equivalent where "Z" must be of selection E, F, H, or J. See documentation on armature cables series EAC for further details.

6)   The 24V power supply for the Emerald servo drive control power must be of a linear type. This will ensure any momentary dropout of main supply voltages do not interrupt the Emerald servo drives control power.

SECTION 2 - OVERVIEW

This manual is organized so that information is easy to find and easy to use. It begins by detailing how to identify the basic electrical characteristics of Emerald Drivers and Emerald Motors (See **Appendix A**), and provides comprehensive product specifications.

Drive configuration and programming is detailed, followed by a comprehensive list of drive fault and status information with trouble shooting remedies. Sections on power and driver wiring, and regen resistor selection follow. A driver/motor tuning overview is included to help with setting up the driver.

2.1   IDENTIFYING EMERALD DRIVES

Emerald Drivers can be identified as follows. This information is on the Driver label:

Your Emerald Driver model number uses this designation:

ESD-XX/YZMO,

WHERE:
XX   = Continuous Driver Current in amps (rms)
5   = 5 Amps
10   = 10 Amps
20   = 20 Amps
40   = 40 Amps
50   = 50 Amps
60   = 60 Amps

Y   = input voltage:
A   = 220 VAC input (3∅ input voltage, 1∅/3∅ ESD-5/AXX only)
C   = 440 VAC input (3∅ input voltage)

Z   = feedback method:
E   = Encoder Feedback

M   = mechanical variations:
P   = Panel Mount

O   = option card:
(Blank) = No option card
R   = Resolver Option

Example: An Emerald Driver designated ESD-10/AEP has a continuous current rating of 10 Amp rms, 220 VAC 3∅ input voltage, encoder feedback, and Panel Mount Construction.

2.2   IDENTIFYING EMERALD MOTORS

Emerald Motors can be identified in one of two ways. This information is on the motor label.

METHOD I

Your Emerald Motor model number uses this designation:

ESMXXX-WWWW/YYZM

WHERE:

XXX	=	Flange size in millimeters
WWWW	=	Rated Power in watts
YY	=	Rated Speed/100 (truncated to 2 digits)
Z	=	Feedback Type E=Encoder (ABZUVW)
M	=	Mechanical Variations (Left blank means no modifications to standard motor). F=Fan over cooled

Example: An Emerald Motor designated ESM130-1800/34E is a 130 mm flange 1800-watt motor with a 3400 rpm rated speed and encoder feedback.

METHOD II

Your Emerald Motor model number uses this designation:

ESMXXXY(W)-M

WHERE:

XXX	=	Flange size in millimeters
Y	=	Stack length A, B, C, etc
W	=	Winding selection (Left blank if only one winding available)
M	=	Mechanical Variations (Left blank means no modifications to standard motor). C = Connectors on motors that come standard with flying leads

Example: A Emerald Motor designated ESM120C(I) is a 120 mm flange motor. Is a 3-stack motor for this flange size and utilizes a low voltage winding.

SECTION 3 - DESCRIPTION

The Emerald Driver can operate as a SERCOS Interface compatible servo drive (SERCOS Mode) or as a standalone single axis controller /drive (CONTROLLER Mode). In either mode of operation, access can be made to a wide variety of hardware features.

The external connections that exist on the Emerald are shown in **Figure 3.1**, and consist of
1 RS-232 port, 1 USB port, I/O BUS interface, SERCOS Fiber Optic Transmitter and Receiver, as well as motor, encoder, and power connections. The Emerald drive also has a +/-10V analog input and general purpose PWM based analog output.

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Figure 3.1 - Emerald Layout

3.1   COMPONENTS

3.1.1   STATUS INDICATORS

1. **STATUS** - This is a seven-segment display, which indicates the current status of the EMERALD driver. (See **Section 7.1)**

2. **I/O STATUS** - This is a bi-color LED that indicates the I/O BUS Expander Interface Status. (See **Section 7.3)**

3. **SERCOS RECEIVER STATUS** - This is a red LED that indicates that the SERCOS Fiber-optic receiver is detecting errors in transmitted data. (See **Section 7.4**)

3.1.2   CONNECTIONS

1. **SERCOS** - These fiber optic Transmitter/Receiver ports allow the drive to be interfaced to a SERCOS Master Controller when the drive is configured in SERCOS Mode (See **Section 4.1.6, 5.5 & Section 6.1**).

2. **COM** - This 6-pin RJ-11 connector is an RS-232 serial communication port. This port can be used to update the firmware in the drive, and to connect EDrive Diagnostic Tools. When configured in CONTROLLER mode (See **Section 6.1**), this port can be used to download CONTROLLER Application Programs. Also, this port can be configured in the CONTROLLER application as an application port. This allows the CONTROLLER to communicate directly to a wide variety of RS-232 devices including operator interfaces (See **Section 4.1.8**).

3. **USB** (USB-B connector) - This standard USB 2.0 device port allows a PC to communicate to the drive via serial to USB 2.0 driver available from IIS. This port can be used to update the firmware in the drive, and to connect EDrive Diagnostic Tools. When in CONTROLLER mode, this port can be used to download CONTROLLER Application Programs (See **Section 4.1.8**). Use standard USB A/B cable to connect to this port.

4. **I/O BUS EXPANDER** - Utilizes standard CAN hardware to interface the EMERALD driver to the ESD-IO16 input/output rack. This allows the EMERALD driver IO support of up to 2 ESD-IO16 racks with up to 32 I/O points utilizing industry standard I/O modules (See **Section 4.1.7 & Appendix B**).

5. **PROBE INPUTS** - High Speed Optically Isolated inputs that can be configured to trap the motor feedback position or the auxiliary encoder position (See **Section 4.1.10 & Section 5**).

6. **MOTOR ENCODER** - This is a 15 Pin Male D connector used for the encoder feedback from the motor to the drive (See **Section 4.1.9 & Section 5**).

7. **ANALOG I/O** - These pins allow connection to the Analog input and the PWM based analog output (See **Section 4.1.10 & Section 5**).

8. **AUXILIARY ENCODER** - Allows the connection of a second encoder input that can be read at the application level and used to implement Master/Slave axis functions in CONROLLER Mode (See **Section 4.1.9 & Section 5**).

9. **24 VOLT DC POWER** - Allows connection of the 24 VDC supply to power the drives control circuitry (See **Section 4.1.3 & Section 5.1**).

3.1.2 CONNECTIONS (cont'd)

10. **CONTROLLER OK** - A normally open dry contact that indicates the Drive is OK and ready to run when the contact is closed (See **Section 5**).

11. **MOTOR/POWER WIRING** - These are terminal blocks used to wire the incoming AC line voltage as well as the motor power cable (See **Section 5**).

12. **OPTIONAL DC LINK REACTOR** - Many of the drivers support the addition of a DC Link reactor to help with EMC noise suppression (See **Section 5.4**).

13. **OPTIONAL REGEN RESISTOR** - All of the drivers support the connection of external regeneration power resistors (See **Section 5.3**).

SECTION 4 - SPECIFICATIONS

4.1 DRIVER SPECIFICATIONS

Emerald Driver	ESD-5	ESD-10	ESD-20	ESD-40	ESD-60
Weight	7.7 lb 3.5 kg	11.2 lb 5.1 kg	13.6 lb 6.2 kg	19.1 lb 8.6 kg	29.9 lb 13.6 kg

4.1.1 MOTOR OUTPUT

Emerald Driver	ESD-5		ESD-10		ESD-20		ESD-40		ESD-60	
Motor Output	PWM, 3 Phase, sine wave									
Output Voltage	200 VRMS									
Speed (RPM)	6000									
PWM Frequency	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz
Continuous Output Current	5 A rms	4 A rms	10 A rms	8 A rms	20 A rms	16 A rms	40 A rms	32 A rms	60 A rms	48 A rms
Maximum Output Current	12.5 A rms	10 A rms	25 A rms	20 A rms	50 A rms	40 A rms	100 A rms	80 A rms	120A rms	96 A rms

4.1.2 MAIN BUS POWER SUPPLY

Emerald Driver	ESD-5		ESD-10/A		ESD-20/A		ESD-40/A		ESD-60/A	
Main Bus Power Supply Voltage	3 Phase (3∅), (1∅/3∅ ESD-5 ONLY) Nominal: 220 VAC, Max Range: 170-264 VAC, 50/60 Hz									
Continuous Input Current	8.7 A/1∅ 5 A/3∅ rms		10 A Rms		20 A rms		40 A rms		60 A rms	
Max Inrush Current	55 A Rms		55 A Rms		20 A rms		40 A rms		63 A rms	
Main Circuit Heat Loss	40 Watts	45 Watts	75 Watts	85 Wats	140 Watts	155 Watts	300 Watts	330 Watts	450 Watts	510 Watts
Main Supply Capacity	1.1 KVA	0.8 KVA	2.2 KVA	1.8 KVA	4.4 KVA	3.6 KVA	8.8 KVA	7.2 KVA	13.2 KVA	10.6 KVA
Internal Regen Absorption Capacity	0 Watts	0 Watts	0 Watts	0 Watts	120 Watts	120 Watts	120 Watts	120 Watts	300 Watts	300 Watts
External Regen Absorption Capacity	2000 Watts	2000 Watts	4000 Watts	4000 Watts	8000 Watts	8000 Watts	16000 Watts	16000 Watts	24000 Watts	24000 Watts

4.1.3 CONTROL POWER SUPPLY

NOTE: The 24V power supply must be short circuit proof and must be able to deliver no more than 10A before shutting down.

Emerald Driver	ESD-5	ESD-10	ESD-20	ESD-40	ESD-60
Power Supply Voltage	24 VDC +/- 10%				
Minimum Power Supply Current Requirements	0.5A	0.5A	1.0 A	1.5A	1.5A
Inrush Current	2A @ 100 ms	2A @ 100 ms	-2A @ 100 ms	2.5A @ 100 ms	2.5A @ 100 ms
Control Circuit Heat Loss	12 Watts	12 Watts	24 Watts	36 Watts	36 Watts
Brown out protection	Can sustain up to a 5 mSec drop in 24 VDC power supply before shutting down.				

4.1.4 CONTROL PERFORMANCE

Feedback	Encoder - (ABZ plus UVW with 5V line driver)
Feedback Resolution	See motor/driver speed torque curves in **Appendix A** for encoder resolution.
Feedback Accuracy	Less than 2 arc minutes
Current Loop Update Rate	62.5 μsec
Velocity Loop Update Rate	250 μsec
Position Loop Update Rate	500 μsec
Speed Regulation	Load (0%-100%): ±0.02% Power (70-264 VAC): ±0.02% Temperature (0-55°C/32-131°F): ±0.2%
Torque Regulation	Power (170-264 VAC): ±2% Temperature (0-55°C/32-131°F): ±2%

4.1.5 ENVIRONMENT

Storage Temperature	-10 to 70°C/14-158°F
Operating Temperature	0 to 55°C/32-131°F
Humidity	35 to 90% Relative Humidity, non-condensing
Shock and Vibration	1 G or less
Operating Conditions	Free of dust, liquids, metallic particles and corrosive gases. Use in a pollution degree 2 environment.
Drive Enclosure	The drive is rated as "open type equipment" by Underwriters Laboratories, Inc.

4.1.6   SERCOS INTERFACE

Interface Version	V02.04
Topology	Multi drop fiber optic ring
Transmission Rate	16 MB/second

4.1.7   SERIAL I/O INTERFACE

Topology	Multi drop CAN Hardware
Protocol	IIS Can
Transmission Rate	500kbits/sec with 1mSec updates

4.1.8   COMMUNICATION PORTS

RS232	Up to 38400 bits/sec
USB	Version 2.0 Compliant

4.1.9   MOTOR/AUXILIARY ENCODER IINPUTS

A B Z U V W (motor encoder only)	On voltage: 5 VDC $\pm$ 5% at 20 ma Off voltage: 1 VDC $\pm$ 5% at 20 ma 2 MHz maximum frequency AB quadratured Optically isolated

4.1.10   PROBE INPUTS

Probe Input 1 Probe Input 2	24 VDC 5mA

4.1.11   ANALOG I/O SIGNALS

Analog Input	Maximum Input Voltage: $\pm$ 10 VDC Input Impedance: 274 kΩ A/D resolution: 1/4096 at $\pm$10V (12 bit)

PWM Analog Output	PWM Output 0 to 15 volts
	50mA maximum out
	PWM Duty Cycle Resolution:
	    1/9372 @ 8kHz
	    1/4686 @ 16kHz

4.1.12 PROTECTION

Fault Checks	Under Voltage, Over Voltage, Motor Short, Output Short, Feedback Loss, Regeneration Resistor Over Temperature and Malfunction, Driver Over Temperature, Following Error, Internal Watchdog Timer, Processor Diagnostics, Communications Errors

4.2 MOTOR SPECIFICATIONS

4.2.1 GENERAL

Duty	Continuous at rated speed and rated torque
Type	Permanent magnet synchronous
Insulation	See motor drawings in **Appendix A**
Sealing	See motor drawings in **Appendix A**
Storage Temperature	-10 to +70ºC/14 to 158ºF
Ambient Operating Temperature	-10 to +40ºC/14 to 104ºF
Shock and Vibration	2 G's
Mounting	Motor can be mounted in any position

4.2.2 FEEDBACK DEVICE

Type: Encoder	ABZ plus UVW 5V line driver

4.2.3 OTHER

Weight Shaft Loading Brake Specifications Dimensions	See motor drawings in **Appendix A**
Torque Ratings Speed Torque Curves	See specifications in **Appendix A**

SECTION 5 - CONNECTIONS/WIRING

This section details the recommended power source requirements necessary to power the Emerald drivers. The Emerald driver has been designed to NRTL certification requirements and this section will recommend the appropriate hardware necessary to maintain this certification as a system. **Figure 5.1** shows the required interconnect to all system components.

NOTE: The Emerald series drive cannot be HI-POT tested in the field due to internal protective devices. Contact Industrial Indexing Systems, Inc. if your system needs to be HI-POT tested.

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Figure 5.1 - Wiring Interconnect

5.1 CONTROL POWER WIRING

The Emerald drive controller power is connected to a 24 VDC supply. See **Section 4.1.3** for control voltage supply requirements. The control power connector has multiple power pins to ease the wiring connections. Drive power can be daisy chained as shown to connect back to power supply. When sizing the 24VDC supply, the load requirements of each drive must be summed up to determine the current rating of the supply. The maximum current that can be carried by the chain is 10 Amp DC. See **Figure 5.1** for the required control power wiring.

5.2 MAIN BUS POWER SUPPLY WIRING

Connect the Emerald drive main bus power (L1, L2, L3) to the incoming line or transformer (See **Section 4.1.2 & Section 5.2.4**). Section 5.2.3 details the required wiring to maintain the NRTL Certification. It is important that the recommended components or equivalent components with NRTL approval be included in system design. See **Figure 5.1** for the required power wiring connections.

5.2.1 SUPPLEMENTAL CIRCUIT PROTECTION

It is required that each driver/motor combination be provided with a circuit protector for each driver and motor pair. All of the drives are suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes.

Drive Part No.	Motor Rated Current (Amps)	Circuit Protectors					
		Edison MEQ FUSE	Rating	Edison JDL FUSE	Rating	Edison CIRCUIT BREAKER	Rating
ESD-5/AEP (single phase)	1.7A to 3.4A	MEQ5	5A	JDL5	5A	----	----
ESD-5/AEP (single phase)	3.4A and up	MEQ10	10A	JDL10	10A	----	----
ESD-5/AEP (3-Phase)	1.7A and up	MEQ5	5A	JDL5	5A	----	----
ESD-10/AEP (3-Phase)	3.4A and up	MEQ10	10A	JDL10	10A	----	----
ESD-20/AEP (3-Phase)	6.7A and up	MEQ20	20A	JDL20	20A	G3P-020	20A
ESD-40/AEP (3-Phase)	13.4A and up	----	----	JDL40	40A	GP3-040	40A

| ESD-60/AEP (3-Phase) | 20.0A and up | ---- | ---- | JDL60 | 60A | GP3-060 | 60A |

Table 5.1 - Recommended Circuit Protector

The circuit protector is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The chart contains specific vendor and size recommendations. Other types of circuit protectors or fuses may be used provided the continuous ratings are equivalent, the instantaneous rating is 10 to 15 times continuous and can support 3 times continuous for at least 3 seconds. Contact ABM INTERNATIONAL, Inc. for specific recommendations of circuit protective devices.

NOTE: All drive sizes can be run on single-phase AC input. However with the exception of the ESD-5/XXX drive, all other drives will have their capabilities reduced by up to 50%. ABM does not recommend running any drive with the exception of the ESD-5/XXX with a single-phase AC input.

5.2.2 CONTACTOR

It is recommended that each driver have an external power bus contactor. **Table 5.2** contains a chart of the recommended contactor for each driver size including manufacturer part number and ratings.

Drive Part No.	Rated Current (Amps)	Contactors					
		Square D	Rating	Siemens	Rating	FUJI	Rating
ESD-5/AEP (single phase)	8.7	LC1D12BD	12	3RT10 17-1BB4x	12	SC-E03G-24VDC	12
ESD-5/AEP (3-Phase)	5	LC1D09BD	9	3RT16 17-1BB4x	9	SC-E02G-24VDC	9
ESD-10/AEP (3-Phase)	10	LC1D12BD	12	3RT10 17-1BB4x	12	SC-E03G-24VDC	12
ESD-20/AEP (3-Phase)	20	LC1D25BD	25	3RT10 26-1BB40	25	SC-E05G-24VDC	25
ESD-40/AEP (3-Phase)	40	LC1D40BD	40	3RT10 35-1BB40	40	SC-E2G-24VDC	40
ESD-60/AEP (3-Phase)	60	LC1D65BD	65	3RT10 44-1BB40	65	SC-E3G-24VDC	65

Table 5.2 - Recommended Circuit Breakers
(Note: Part number specifies 24 VCD coils)

The contactor is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific vendor and size recommendations. Other types of contactors may be used provided the continuous ratings are equivalent and the maximum instantaneous rating is 10 to 15 times continuous. The driver is equipped with a soft start circuit to limit the contactor inrush current.

To utilize the DRIVE_OK output relay to drive the contactor, the coil voltage should be 24 VDC and no more than 500 mA current draw. An appropriate suppressor must be placed across DRIVE_OK as shown in wiring diagram.

5.2.3 WIRE SIZES

It is required that each driver be installed with the appropriate size wire for proper operation. **Table 5.3** shows a chart of recommended wire gauges and terminal connection tightening torques for each driver size.

The wire is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific METRIC and AWG size recommendations for stranded wire. All wires to supply earth to the drive shall be of the same wire size used for the AC source. Use only copper wire rated for 60/75 degree C or greater. The driver terminals are specifically designed to handle the recommended wire gauge with lug or ferrule terminations. See wiring diagrams for more details.

| Drive Part No. | Rated Current (Amps) | Wire Size | | Required Tightening torque on power wiring terminals (LB-IN) |
		(AWG)	(MM^2)	
ESD-5/AEP (single phase)	8.7	14	2	4.5
ESD-5/AEP (3-Phase)	5	14	2	4.5
ESD-10/AEP (3-Phase)	10	14	2	13.5
ESD-20/AEP (3-Phase)	20	12	3.5	13.5
ESD-40/AEP (3-Phase)	40	10	5.5	13.5
ESD-60/AEP (3-Phase)	60	8	8.5	22.5

Table 5.3 - Recommended Bus Power Wire Size

Note: ** Field wiring connection shall be made by a NRTL Certified crimped on ferrule sized for the wire gauge involved. Ferrule must be fixed using the crimp tool specified by the connector manufacturer.

5.2.4 TRANSFORMERS

Isolating the driver from the facility power line with a transformer is recommended but not required. A transformer may be required to step down or step up the facility power line to meet the driver voltage specifications in **Section 4**.

If a transformer is used, select a transformer with the following characteristics:

- Isolation type.
- Load regulation less than 10%.
- Ability to provide 3 times rated current for 3 to 5 seconds without saturation.
- Ability to drive load with a power factor of 0.85.
- Primary or secondary taps to provide -10%; nominal; +10%; supply voltage.

To achieve maximum performance from the driver, the power input to the driver should be as close to nominal driver input voltage rating as possible. The facility line voltage varies through wide ranges in many parts of the world and it is recommended to match the nominal facility voltage to the nominal input voltage rating of the driver with a transformer. This gives the system the maximum operating range with facility line voltage fluctuations.

If the line voltage is too low, intermittent under voltage alarms may occur. A high line voltage will result in excessive regeneration dumping or intermittent over voltage alarms.

Buck boost transformers may be used to optimally match the facility line voltage to the driver line voltage rating. Buck boost transformers can be used with or without an isolation transformer. If buck boost transformers are used in conjunction with an isolation transformer, it is best to put the buck boost transformers on the primary side of the isolation transformer.

As a general rule the transformer rating can be calculated using the following formulas:

For single phase transformer:

$$\text{Transformer Capacity (VA)} = \frac{\text{Rated Mechanical Output (Watts)}}{0.7}$$

Where: Rated Mechanical Output is from Emerald Motor and Drive Package rating.
      0.7 = motor/drive efficiency and single phase full wave rectifier factor

Example: Select transformer for a Delta S-200HRA motor/drive package

$$\text{Transformer Capacity (VA)} = \frac{200}{0.7} = 285 \text{ VA}$$

For three phase transformer:

$$\text{Transformer Capacity (Watts)} = \frac{\text{Rated Mechanical Output (Watts)}}{0.85}$$

Where: Rated Mechanical Output is from Emerald Motor and Drive Package rating.
      0.85 is motor/drive efficiency and three phase rectifier factor

Example: Select transformer for a Delta S-6500HRA motor/drive package

$$\text{Transformer Capacity (VA)} = \frac{6500}{0.85} = 7647 \text{ VA}$$

5.2.4   TRANSFORMERS (cont'd)

One transformer can supply multiple motor/driver packages. Simply add the rated mechanical output of the motor/driver packages together and use the above formulas. If one transformer is used to supply multiple drivers, be sure to protect each driver with the appropriate circuit breaker or fuse.

IIS offers a full line of transformers for various line voltage and frequencies, enclosed and open frame types. Contact ABM Application Engineering Department for full details.

5.2.5   WIRING PRACTICES AND GROUNDING

All wiring must conform to accept standards such as NEMA and NEC codes. Signal and low voltage I/O wires must be physically separated from high voltage wires by at least 12 inches or separated by a suitable barrier such as steel conduit or wiring trough separator.

The driver must be adequately grounded for proper operation and to provide personnel safety. The proper grounding technique is shown in **Figure 5.1.**

5.3   DRIVER REGENERATION CAPACITIES

The Emerald motor and driver have the ability to act as a brake for a rotating load. This condition typically occurs during the deceleration of the load or when the system is stopping a vertical load such as an elevator or lift. In both cases, the driver may have to absorb the mechanical and potential energy in the system. The driver must absorb the energy if the energy in the load exceeds to mechanical losses in the system.

The driver has 2 ways to absorb the energy from the load.

- Store the energy by charging the internal main DC bus capacitors (E_C)
- Dissipate the energy using a regeneration resistor (P_R)

The Emerald driver internal energy absorption capacities are as shown in **Table 5.4**.

DRIVER SIZE	REGEN CAPACITY (P_R)	CHARGING CAPACITY (E_C)
ESD-5	0 W	28J
ESD-10	0 W	38J
ESD-20	120 W	79J
ESD-40	120 W	159J
ESD-60	300 W	239J

Table 5.4 - Energy Absorption Capabilities

The Emerald drivers are equipped with internal circuitry to detect a rise in the main DC power bus indicating energy absorption. If the DC power bus reaches approximately 410 VDC, the regeneration circuit is turned on to prevent the main DC power bus from rising to 430 VDC which will result in an over voltage alarm F02.

5.3.1 SELECTION OF AN EXTERNAL REGENERATION RESISTOR

The amount of energy stored in the moving components of the system must be calculated and compared to the energy absorption capacity of the driver to determine if an external regeneration resistor is required.

The stored energy is of two basic types, kinetic energy in the form of a moving mass and potential energy of a mass being held against gravity.

$$E_k = 0.5 * (J_M + J_L) * (2 * \pi * N / 60)^2$$

$$E_P = (2 * \pi * N * T_g * t_b / 60)$$

Calculate the system losses in the motor, driver and friction.

$$E_L = (P_M + (\pi * N * T_f / 60)) * t_a$$

Calculate the regeneration power.

$$P_R = (E_k + E_P - E_L - E_C) / t_c$$

If regeneration power P_R is greater than 0.0, a regeneration resistor will be needed to prevent the main DC power bus from generating an over voltage alarm F02.

Where:

E_k = Net kinetic energy Joules
E_P = Net Potential energy Joules
E_L = Energy loss due to friction Joules
E_C = Driver charging capacity Joules
J_M = Motor rotor inertia kg-m^2
J_L = Load inertia kg-m^2
N = Motor speed in RPM
P_M = Motor loss watts (10% of motor rating)
T_f = System friction torque N-m
T_g = Net torque to hold up load against gravity N-m
P_R = Regen power watts
t_a = Deceleration time ⎤
t_b = Move time   See **Figure 5.2**
t_c = Cycle time ⎦

* The above equations are reasonable approximations.

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Figure 5.2 - Time

5.3.1   SELECTION OF AN EXTERNAL REGENERATION RESISTOR (cont'd)

Drivers ESD-5 and ESD-10 do not contain an internal regeneration resistor. If a regeneration resistor is required, an external resistor with a power rating of at least P_R watts must be connected.

Drivers ESD-20 through ESD-60 contain internal regeneration resistors. If the internal regeneration resistor capacity is greater than P_R watts, no external resistor is needed. If the internal resistor is not large enough, an external resistor will need to be used. The external resistor is wired in parallel with the internal resistor. Therefore care must be taken to calculate the appropriate resistance and power value such that the internal resistor power rating is not exceeded.

Calculation of External Regeneration Resistor on drive with internal Regen resistor:

$$\text{Since } P_R = \frac{E^2}{R_R} \text{ then:} \quad E^2 = P_R * R_R = P_{R(INTERNAL)} * R_{R(INTERNAL)} = P_{R(INTERNAL)} * R_{R(INTERNAL)}$$

(for Parallel Resistances)

It then can be derived that:

$$R_{R(EXTERNAL)} \leq \frac{P_{R(INTERNAL)} * R_{R(INTERNAL)}}{P_{R(EXTERNAL)}}$$

DRIVER SIZE	$P_{R(INTERNAL)}$ Watts	$R_{R(INTERNAL)}$ Ohms	$R_{R(EXTERNAL)}$ Min Ohms	P_R Max Watts	WIRE GAUGE
ESD-5	N/A	N/A	30	400	14 AWG 1.25 mm²
ESD-10	N/A	N/A	30	600	14 AWG 1.25 mm²
ESD-20	120	100	10	1300	12 AWG 3.5 mm²
ESD-40	120	100	5	2500	10 AWG 5.5 mm²
ESD-60	300	50	3	5000	8 AWG 16 mm²

Table 5.5 - Regeneration Resistor Selection Data

Figure 5.1 shows how to connect an external regeneration resistor to the Emerald drivers.

5.3.2 STANDARD REGENERATION RESISTOR PACKAGES

In general, wound metal ribbon resistors are recommended for this type of application. IIS offers a complete line of enclosed panel mounted regen resistor units to complement the Emerald driver. Various combinations of series and parallel connections are allowed to provide adequate regen resistor capacity.

IIS P/N	Description
MFS30A300J*	30 Ohm 30 Watts
RGH200-30*	30 Ohm 200 Watts
DRGN-20/400*	20 Ohm 400 Watts
DRGN-45/420	45 Ohm 420 Watts
DRGN-22.5/655	22.5 Ohm 655 Watts
DRGN-15/880	15 Ohm 880 Watts
DRGN-11.25/1120	11.25 Ohm 1120 Watts

*Not UL/CE approved

EXAMPLE CALCULATION:

If 4 KW of regen were needed on an ESD-60 driver, four (4) DRGN-11.25/1120 units could be connected as follows to yield 11.25 Ohms at 4480 Watts.
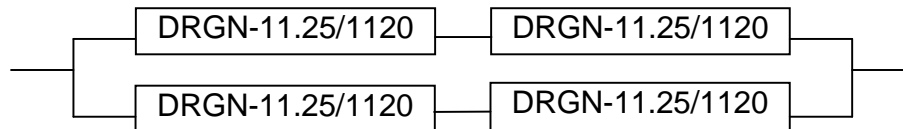
```
┌──────────────────┬──────────────────┐
│ DRGN-11.25/1120  │ DRGN-11.25/1120  │
├──────────────────┼──────────────────┤
│ DRGN-11.25/1120  │ DRGN-11.25/1120  │
└──────────────────┴──────────────────┘
```

DRAWING NUMBER	**DESCRIPTION**
MFS30A300J	Resistor
RGH200-30	Regen Resistor
DRGN-20/400	Regen Resistor
DRGN-45/420	Regen Resistor
DRGN-45/420-2	Regen Resistor
DRGN-22.5/655	Regen Resistor
DRGN-15/880	Regen Resistor
DRGN-11.25/1120	Regen Resistor

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5.4   DC LINK REACTOR

The Emerald driver provides the ability to connector an external DC LINK reactor to help with CE requirements. Proper selection of the inductance is application specific. Please consult IIS factory additional information. See **Figure 5.1** for proper connection of the line reactor.

5.5   SERCOS TX/RX CONNECTIONS

When the driver is configured as a SERCOS Device Slave (See **Figure 6.1**), the Emerald will need to be connected to a SERCOS Device Master. SERCOS Fiber Optic cable are connected from the Transmitter (TX) of one device to Receiver (RX) of the next device to form a ring with one Master and multiple slave devices (See **Figure 5.3**).

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Figure 5.3 - Connecting the SERCOS Ring

5.6 TOUCHSCREEN & PC CONNECTIONS

The Emerald drive (in Controller Mode) may be connected to a touchscreen interface with PC Support or directly to a PC (See **Figure 5.4**).

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Figure 5.4 - Connecting the Emerald to a Touchscreen & PC

SECTION 6 - CONFIGURATION & PROGRAMMING

This section gives information on the Operation Data and Procedure Commands that can be transmitted over the SERCOS Communication ring, over RS-232, or over USB. It also details the settings needed in order to communicate to the drive over the SERCOS ring.

6.1   CONFIGURATION SWITCH

The eight DIP switches on top of the Emerald Drive are used to set the SERCOS device address and fiber optic transmitter intensity, in SERCOS mode. Turning all of the switches on will put the drive in CONTROLLER mode (See **Figure 6.1**).

A Device ID of Zero will put the Device in repeater mode and it will not recognize commands over SERCOS.

Switches 7 and 8 set the transmitter power. The table below lists the possible settings.

SERCOS Transmitter Power

SETTING		TX POWER LEVEL	LENGTH OF TRANSMISSION LINE
SW7	SW8		
0	0	1	0-15 m
1	0	2	15-30 m
0	1	3	30-45 m
1	1	4	>45 m

SERCOS Device ID

SW1-SW6	SERCOS Address
000000	0
100000	1
010000	2
---	---
011111	62

Note: Turning all of the switches ON will configure the drive in CONTROLLER Mode (SW1-SW8). Then connect the controller directly to the PC running EDE Software.
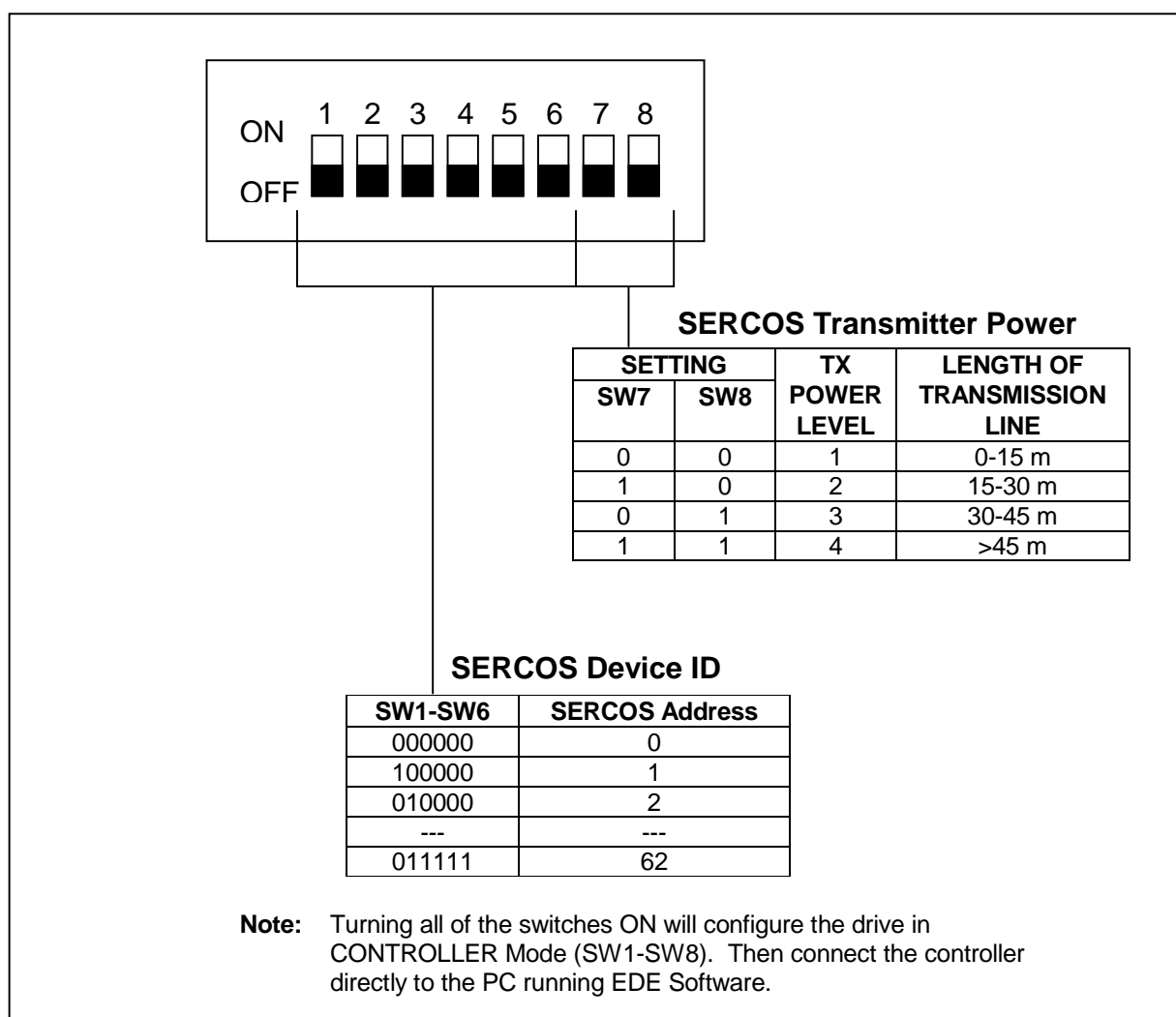
Figure 6.1 - Configuration Switch Settings

6.2 IDENTIFICATION NUMBERS

The Emerald Drive has an extensive list of Identification Numbers (IDN) to access its Operation Data and Procedure Commands. Refer to EDE or manufacturer's controller documentation for how to set IDN Parameters.

6.2.1 IDN LIST IN NUMERICAL ORDER

IDN	NAME
(STANDARD PARAMETERS)	
00001	Control Unit Cycle Time (t_{Ncyc})
00002	Communication Cycle Time (t_{Scyc})
00003	Shortest AT Transmission Starting Time (t_{1min})
00004	Transmit/Receive Transition Time (t_{ATMT})
00005	Minimum Feedback Processing Time (t_5)
00006	AT Transmission Starting Time (t_1)
00007	Feedback Acquisition Capture Point (t_4)
00008	Command Value Valid Time (t_3)
00009	Position of Data Record in MDT
00010	Length of MDT
00011	Class 1 diagnostic (C1D)
00012	Class 2 diagnostic (C2D)
00013	Class 3 diagnostic (C3D)
00014	Interface Status
00015	Telegram Type Parameter
00016	Configuration List of AT
00017	IDN - List of all Operation Data
00018	IDN - List of Operation Data for Phase 2
00019	IDN - List of Operation Data for Phase 3
00021	IDN - List of Invalid Operation Data for Phase 2
00022	IDN - List of Invalid Operation Data for Phase 3
00024	Configuration List of MDT
00025	IDN - List of all Procedure Commands
00028	MST Error Counter
00029	MDT Error Counter
00030	Manufacturer Version
00032	Primary Operation Mode
00033	Secondary Operation Mode 1
00034	Secondary Operation Mode 2
00035	Secondary Operation Mode 3
00036	Velocity Command Value
00040	Velocity Feedback Value
00041	Homing Velocity
00042	Homing Acceleration
00043	Velocity Polarity Parameter
00044	Velocity Data Scaling Type
00047	Position Command Value
00051	Position Feedback Value 1(Motor Feedback)
00052	Reference Distance 1
00053	Position Feedback Value 2 (Auxiliary Encoder Feedback)
00055	Position Polarity Parameters
00057	Position Window
00076	Position Data Scaling Type
00080	Torque Command Value
00082	PositiveTorque Limit
00083	Negative Torque Limit
00084	Torque Feedback Value

6.2.1   IDN LIST IN NUMERICAL ORDER (cont'd)

IDN	NAME
00085	Torque Polarity Parameter
00086	Torque/Force Data Scaling Type
00088	Receive to Receive Recovery Time (t_{MTSY})
00089	MDT Transmission Starting Time (t_2)
00090	Command Value Proceeding Time (t_{MTSG})
00091	Bipolar Velocity Limit Value
00092	Bipolar Torque Limit Value
00095	Diagnostic Message
00096	Slave Arrangment (SLKN)
00097	Mask Class 2 Diagnostics
00098	Mask Class 3 Diagnostics
00099	Reset Class 1 Diagnostics
00100	Velocity Loop Proportional Gain
00101	Velocity Loop Integral Action Time
00102	Velocity Loop Differential Time
00104	Position Loop Kv Factor
00105	Position Loop Integral Action Time
00106	Current Loop Proportional Gain 1
00107	Current Loop Integral Action Time 1
00109	Motor Peak Current
00110	Amplifier Peak Current
00112	Amplifier Rated Current
00113	Maximum Motor Speed
00119	Current Loop Proportional Gain 2
00120	Current Loop Integral Action Time 2
00124	Standstill Window
00125	Velocity Threshold
00126	Torque Threshold
00127	Phase 3 Transition Check
00128	Phase 4 Transition Check
00129	Product Specific Class 1 Diagnostics
00130	Probe 1 Value Positive Edge
00131	Probe 1 Value Negative Edge
00132	Probe 2 Value Positive Edge
00133	Probe 2 Value Negative Edge
00134	Master Control Word
00135	Drive Status Word
00138	Bipolar Acceleration Limit Value
00140	Controller Type
00142	Application Type
00143	SERCOS Interface Version
00147	Homing Parameter
00148	Drive Controlled Homing Procedure Command
00157	Velocity Window
00159	Monitoring Window
00160	Acceleration Data Scaling Type
00161	Acceleration Data Scaling Factor
00162	Acceleration Data Scaling Exponent
00169	Probe Control Parameter
00170	Probing Cycle Procedure Command
00179	Probe Status
00185	Length of the configurable Data Record in the AT
00186	Length of the configurable Data Record in the MDT
00187	IDN - List of configurable Data Record in the AT

6.2.1 IDN LIST IN NUMERICAL ORDER (cont'd)

IDN	NAME
00188	IDN - List of configurable Data Record in the MDT
00189	Following Distance
00196	Motor Rated Current
00200	Amplifier Warning Temperature
00203	Amplifier Shut-Down Temperature
00206	Drive On Delay Time
00207	Drive Off Delay Time
00208	Temperature Data Scaling Type
00273	Maximum Drive off delay time
00295	Drive Enable Delay Time
00296	Velocity Feed Forward Gain
00300	Real-time Control Bit 1
00301	Allocation of Real-time Control Bit 1
00302	Real-time Control Bit 2
00303	Allocation of Real-time Control Bit 2
00304	Real-time Status Bit 1
00305	Allocation of Real-time Status Bit 1
00306	Real-time Status Bit 2
00307	Allocation of Real-time Status Bit 2
00348	Acceleration Feed Forward Gain
00380	DC Bus Voltage
00384	Amplifier Temperature
00400	Home Switch
00401	Probe 1
00402	Probe 2
00403	Position Feedback Value Status
00405	Probe 1 Enable
00406	Probe 2 Enable
00409	Probe 1 Positive Latched
00410	Probe 1 Negative Latched
00411	Probe 2 Positive Latched
00412	Probe 2 Negative Latched

IDN	NAME
(IIS SPECIFIC PARAMETERS)	
32769	U Current Sensor Calibration Offset
32770	U Current Sensor Calibration Gain
32771	V Current Sensor Calibration Offset
32772	V Current Sensor Calibration Gain
32773	U Current Sensor
32774	V Current Sensor
32775	Procedure Command Remove Calibration Write-Protect
32776	Procedure Command Save Calibration Parameters
32777	DC Bus Calibration Offset
32778	DC Bus Calibration Gain
32783	Analog Input Calibration Offset
32784	Analog Input Calibration Gain
32785	W Current Sensor Calibration Offset
32786	W Current Sensor Calibration Gain
32787	W Current Sensor
32788	Current fault factor
33000	Digital Outputs 1
33001	Digital Outputs 2
33200	Probe Source
33300	I/O Device 1 Configuration

6.2.1 IDN LIST IN NUMERICAL ORDER (cont'd)

IDN	NAME
33301	I/O Device 2 Configuration
33304	I/O Device 1 Type
33305	I/O Device 2 Type
33500	Digital Inputs 1
33501	Digital Inputs 2
33600	Analog Input 1
33650	PWM Output
33700	Alarm History
33701	Current Drive Alarm
33702	Drive Alarm Bitmap 1
33703	Drive Alarm Bitmap 2
33704	Drive Alarm Bitmap 3
33705	Drive Alarm Bitmap 4
33799	Clear Alarm History Procedure Command
33800	Following Error Delay Time
33801	PWM Frequency
34000	Motor Code
34003	Motor Poles
34004	Feedback Type
34005	Resolver Cycles
34006	Motor Feedback Configuration
34007	Motor Rated Speed
34009	Overload Time
34011	Encoder Line Count
34224	Position Loop Differential Time
34243	Current Command (Amps)
34244	Current Feedback (Amps)
34245	Velocity Command (RPM)
34246	Velocity Feedback (RPM)
34260	Motor Phase Angle
34280	Current Command Filter Rejection Frequency
34281	Current Command Filter Bandwidth
34282	Tuning Parameter List
34283	Motor Parameter List
34284	Monitor Parameter List
34285	Monitor I/O List
34286	Monitor Alarm List
34287	Serial Error Register
34288	Power Board ID
34300	Auxiliary Encoder Features Setup
34810	Home Switch IDN
34811	Home Switch Bit
34812	Boot ROM SFO Number
34813	Regen RMS Power
34820	Password
34821	Test Mode Procedure Command
34822	Power Transistor Bitmap
35000	Resolver Card Configuration
35001	Resolver Feedback Value
35002	Resolver Feedback Polarity Parameter
35011	Auxiliary Feedback Value
35012	Auxiliary Feedback Polarity Parameter
35020	Position Feedback 1 Configuration
35021	Position Feedback 2 Configuration

6.2.2 IDN LIST BY FUNCTION

Position Control	
00032	Primary Operation Mode
00033	Secondary Operation Mode 1
00034	Secondary Operation Mode 2
00035	Secondary Operation Mode 3
00047	Position Command Value
00051	Position Feedback Value 1(Motor Feedback)
00053	Position Feedback Value 2 (Auxiliary Encoder Feedback)
00055	Position Polarity Parameters
00057	Position Window
00076	Position Data Scaling Type
00138	Bipolar Acceleration Limit Value
00159	Monitoring Window
00160	Acceleration Data Scaling Type
00161	Acceleration Data Scaling Factor
00162	Acceleration Data Scaling Exponent
00189	Following Distance
33800	Following Error Delay Time
34300	Auxiliary Encoder Features Setup
35000	Resolver Card Configuration
35001	Resolver Feedback Value
35002	Resolver Feedback Polarity Parameter
35011	Auxiliary Feedback Value
35012	Auxiliary Feedback Polarity Parameter
35020	Position Feedback 1 Configuration
35021	Position Feedback 2 Configuration

Velocity Control	
00032	Primary Operation Mode
00033	Secondary Operation Mode 1
00034	Secondary Operation Mode 2
00035	Secondary Operation Mode 3
00036	Velocity Command Value
00040	Velocity Feedback Value
00043	Velocity Polarity Parameter
00044	Velocity Data Scaling Type
00091	Bipolar Velocity Limit Value
00124	Standstill Window
00125	Velocity Threshold
00138	Bipolar Acceleration Limit Value
00157	Velocity Window
00160	Acceleration Data Scaling Type
00161	Acceleration Data Scaling Factor
00162	Acceleration Data Scaling Exponent

Torque Control	
00032	Primary Operation Mode
00033	Secondary Operation Mode 1
00034	Secondary Operation Mode 2
00035	Secondary Operation Mode 3
00080	Torque Command Value
00082	PositiveTorque Limit
00083	Negative Torque Limit

6.2.2 IDN LIST BY FUNCTION (cont'd)

00084	Torque Feedback Value
00085	Torque Polarity Parameter
00086	Torque/Force Data Scaling Type
00092	Bipolar Torque Limit Value
00126	Torque Threshold

Communications

00001	Control Unit Cycle Time (t_{Ncyc})
00002	Communication Cycle Time (t_{Scyc})
00003	Shortest AT Transmission Starting Time (t_{1min})
00004	Transmit/Receive Transition Time (t_{ATMT})
00005	Minimum Feedback Processing Time (t_5)
00006	AT Transmission Starting Time (t_1)
00007	Feedback Acquisition Capture Point (t_4)
00008	Command Value Valid Time (t_3)
00009	Position of Data Record in MDT
00010	Length of MDT
00014	Interface Status
00015	Telegram Type Parameter
00016	Configuration List of AT
00017	IDN - List of all Operation Data
00018	IDN - List of Operation Data for Phase 2
00019	IDN - List of Operation Data for Phase 3
00021	IDN - List of Invalid Operation Data for Phase 2
00022	IDN - List of Invalid Operation Data for Phase 3
00024	Configuration List of MDT
00025	IDN - List of all Procedure Commands
00088	Receive to Receive Recovery Time (t_{MTSY})
00089	MDT Transmission Starting Time (t_2)
00090	Command Value Proceeding Time (t_{MTSG})
00096	Slave Arrangment (SLKN)
00127	Phase 3 Transition Check
00128	Phase 4 Transition Check
00134	Master Control Word
00135	Drive Status Word
00185	Length of the configurable Data Record in the AT
00186	Length of the configurable Data Record in the MDT
00187	IDN - List of configurable Data Record in the AT
00188	IDN - List of configurable Data Record in the MDT
00206	Drive On Delay Time
00207	Drive Off Delay Time
00273	Maximum Drive off delay time
00295	Drive Enable Delay Time
00300	Real-time Control Bit 1
00301	Allocation of Real-time Control Bit 1
00302	Real-time Control Bit 2
00303	Allocation of Real-time Control Bit 2
00304	Real-time Status Bit 1
00305	Allocation of Real-time Status Bit 1
00306	Real-time Status Bit 2
00307	Allocation of Real-time Status Bit 2

6.2.2 IDN LIST BY FUNCTION (cont'd)

Diagnostics	
00011	Class 1 diagnostic (C1D)
00012	Class 2 diagnostic (C2D)
00013	Class 3 diagnostic (C3D)
00028	MST Error Counter
00029	MDT Error Counter
00095	Diagnostic Message
00097	Mask Class 2 Diagnostics
00098	Mask Class 3 Diagnostics
00099	Reset Class 1 Diagnostics
00110	Amplifier Peak Current
00112	Amplifier Rated Current
00129	Product Specific Class 1 Diagnostics
00200	Amplifier Warning Temperature
00203	Amplifier Shut-Down Temperature
00380	DC Bus Voltage
00384	Amplifier Temperature
33700	Alarm History
33701	Current Drive Alarm
33702	Drive Alarm Bitmap 1
33703	Drive Alarm Bitmap 2
33704	Drive Alarm Bitmap 3
33705	Drive Alarm Bitmap 4
33799	Clear Alarm History Procedure Command
34243	Current Command (Amps)
34244	Current Feedback (Amps)
34245	Velocity Command (RPM)
34246	Velocity Feedback (RPM)
34260	Motor Phase Angle
34282	Tuning Parameter List
34283	Motor Parameter List
34284	Monitor Parameter List
34285	Monitor I/O List
34286	Monitor Alarm List
34287	Serial Error Register
34813	Regen Resistor RMS Power

Probes	
00130	Probe 1 Value Positive Edge
00131	Probe 1 Value Negative Edge
00132	Probe 2 Value Positive Edge
00133	Probe 2 Value Negative Edge
00169	Probe Control Parameter
00170	Probing Cycle Procedure Command
00179	Probe Status
00401	Probe 1
00402	Probe 2
00405	Probe 1 Enable
00406	Probe 2 Enable
00409	Probe 1 Positive Latched
00410	Probe 1 Negative Latched
00411	Probe 2 Positive Latched
00412	Probe 2 Negative Latched
33200	Probe Source

6.2.2   IDN LIST BY FUNCTION (cont'd)

Inputs/Outputs

33000	Digital Outputs 1
33001	Digital Outputs 2
33300	I/O Device 1 Configuration
33301	I/O Device 2 Configuration
33304	I/O Device 1 Type
33305	I/O Device 2 Type
33500	Digital Input 1
33501	Digital Input 2
33600	Analog Input 1
33650	PWM Output

Tuning Parameters

00100	Velocity Loop Proportional Gain
00101	Velocity Loop Integral Action Time
00102	Velocity Loop Differential Time
00104	Position Loop Kv Factor
00105	Position Loop Integral Action Time
00106	Current Loop Proportional Gain 1
00107	Current Loop Integral Action Time 1
00119	Current Loop Proportional Gain 2
00120	Current Loop Integral Action Time 2
00296	Velocity Feed Forward Gain
00348	Acceleration Feed Forward Gain
34224	Position Loop Differential Time
34280	Current Command Filter Rejection Frequency
34281	Current Command Filter Bandwidth

Miscellaneous

00030	Manufacturer Version
00140	Controller Type
00142	Application Type
00143	SERCOS Interface Version
00208	Temperature Data Scaling Type
32788	Current fault factor
33801	PWM Frequency
34288	Power Board ID
34812	Boot ROM SFO Number

Homing

00041	Homing Velocity
00042	Homing Acceleration
00052	Reference Distance 1
00147	Homing Parameter
00148	Drive Controlled Homing Procedure Command
00400	Home Switch
00403	Position Feedback Value Status
34810	Home Switch IDN
34811	Home Switch Bit

6.2.2 IDN LIST BY FUNCTION (cont'd)

Motor Parameters

00109	Motor Peak Current
00113	Maximum Motor Speed
00196	Motor Rated Current
34000	Motor Code
34003	Motor Poles
34004	Feedback Type
34005	Resolver Cycles
34006	Motor Feedback Configuration
34007	Motor Rated Speed
34009	Overload Time
34011	Encoder Line Count

Calibration

32769	U Current Sensor Calibration Offset
32770	U Current Sensor Calibration Gain
32771	V Current Sensor Calibration Offset
32772	V Current Sensor Calibration Gain
32773	U Current Sensor
32774	V Current Sensor
32775	Procedure Command Remove Calibration Write-Protect
32776	Procedure Command Save Calibration Parameters
32777	DC Bus Calibration Offset
32778	DC Bus Calibration Gain
32783	Analog Input Calibration Offset
32784	Analog Input Calibration Gain
32785	W Current Sensor Calibration Offset
32786	W Current Sensor Calibration Gain
32787	W Current Sensor
34820	Password
34821	Test Mode Procedure Command
34822	Power Transistor Bitmap

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS

00001: CONTROL UNIT CYCLE TIME, (t_{Ncyc})

The control unit cycle time defines the cyclic interval during which the control unit makes new command values available. The control unit cycle time ($t_{Ncyc)}$ must be set equal to the communication cycle time (t_{Scyc}). This value is calculated and loaded into the drive by the Master Control Unit in Phase 2. This value becomes active in phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	500 - 5000	1 uSec	Phases 2, 3 and 4	Phase 2	5000

00002: COMMUNICATION CYCLE TIME, (t_{Scyc})

The communication cycle time of the interface defines the intervals during which the cyclic data are transferred. The communication cycle can be set from 500uSec to 5000 uSec in steps of 250 uSec. This value is calculated and loaded into the drive by the Master Control Unit in Phase 2. This value becomes active in phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	500 - 5000	1 uSec	Phases 2, 3 and 4	Phase 2	5000

00003: SHORTEST AT TRANSMISSION STARTING TIME, (t_{1min})

Indicates the time requirement of the drive between the end of the reception of the MST and the start of the transmission of the AT. Read by the Master Controller in Phase 2, t_{1min} is used to calculate the AT Transmission Starting Time, t_1 (IDN 00006).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	15	1 uSec	Phases 2, 3 and 4	None	

00004: TRANSMIT/RECEIVE TRANSITION TIME, (t_{ATMT})

Time required by the drive to switch from transmitting the AT to receiving the MDT. Read by the Master Controller in Phase 2 and is used to determine the MDT starting time, t_2 (IDN 00089).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0	1 uSec	Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00005: MINIMUM FEEDBACK PROCESSING TIME, (t_5)

Time required by the drive between the start of feedback acquisition and the arrival of the next MST. This value is loaded by the Master Controller in Phase 2 and becomes active in Phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	200	1 uSec	Phases 2, 3 and 4	None	

00006: AT TRANSMISSION STARTING TIME, (t_1)

The time the drive sends the AT after the end of the MST. This value is loaded by the Master Controller in Phase 2 and becomes active in Phase 3. ($t_1 \geq t_{1min}$)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	15 - 5000	1 uSec	Phases 2, 3 and 4	Phase 2	12

00007: FEEDBACK ACQUISITION CAPTURE POINT, (t_4)

The time the drive captures the AT Data. This value is loaded by the Master Controller in Phase 2 and becomes active in Phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - (tScyc - t5)	1 uSec	Phases 2, 3 and 4	Phase 2	0

00008: COMMAND VALUE VALID TIME, (t3)

The time the drive can start using the data sent in the MDT. Set by the Master Controller in Phase 2.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 5000	1 uSec	Phases 2, 3 and 4	Phase 2	0

00009: POSITION OF DATA RECORD IN MDT

The position within the MDT that the drives command data can be obtained. Set by the Master Controller in Phase 2.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65531	1 byte	Phases 2, 3 and 4	Phase 2	1

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00010: LENGTH OF MDT

The length of the MDT, expressed in bytes, includes data records for all drives. Set by the Master Controller in Phase 2.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	4 - 65534	1 byte	Phases 2, 3 and 4	Phase 2	4

00011: CLASS 1 DIAGNOSTICS (C1D)

Indicates a Drive Shutdown Error.

A Drive error situation leads to the following.
   a) Drive safely decelerates to and releases torque when stopped.
   b) The shutdown error Bit (Bit 13) is set to 1 in the drive status. IDN 99 must be issued and no Class 1 diagnostic errors exist to clear the error bit.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Reserved
Bit 1:	Amplifier over temperature error
Bit 2:	Reserved
Bit 3:	Reserved
Bit 4:	Reserved
Bit 5:	Feedback error
Bit 6:	Error in the "commutation" system
Bit 7:	Over current error
Bit 8:	Over voltage error
Bit 9:	Under voltage error
Bit 10:	Reserved
Bit 11:	Excessive position deviation
Bit 12:	Communication error
Bit 13:	Reserved
Bit 14:	Reserved
Bit 15:	Manufacturer-specific error (see IDN 00129)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes		1 byte	Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00012: CLASS 2 DIAGNOSTICS (C2D)

Indicates a Drive Shutdown Warning.

The shutdown warning Bit (Bit 12) is set to 1 in the drive status.
When this IDN is read the warning bit is cleared and this IDN is reset to 0.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Reserved
Bit 1:	Amplifier over temperature warning
Bit 2:	Reserved
Bit 3:	Reserved
Bit 4:	Reserved
Bit 5:	Reserved
Bit 6:	Reserved
Bit 7:	Reserved
Bit 8:	Reserved
Bit 9:	Under Voltage warning
Bit 10:	Reserved
Bit 11:	Reserved
Bit 12:	Reserved
Bit 13:	Reserved
Bit 14:	Reserved
Bit 15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes		1 byte	Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00013: CLASS 3 DIAGNOSTICS (C3D)

Drive operation status flags.

The status flag Bit (Bit 11) is set to 1 in the drive status when a change in C3D occurs. When this IDN is read the status bit (Bit 11) in the drive status is cleared.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	$n_{feedback} = n_{command}$ (See: Velocity Window IDN 00157)
Bit 1:	$n_{feedback} = 0$ (See: Standstill Window IDN 00124)
Bit 2:	$\mid n_{feedback} \mid < \mid n_x \mid$ (See: Velocity Threshold IDN 00125)
Bit 3:	$\mid T \mid >= \mid T_x \mid$ (See: Torque Threshold IDN 00126)
Bit 4:	$\mid T \mid >= \mid T_{limit} \mid$ (See: Torque Limit IDN 00082, IDN 00083, and IDN 00092)
Bit 5:	$\mid n_{command} \mid > \mid n_{limit} \mid$ (See: Velocity Limit IDN 00091)
Bit 6:	In Position (See: Position Window IDN 00057)
Bit 7 - 15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes		1 byte	Phases 2, 3 and 4	None	

00014: INTERFACE STATUS

Status of the SERCOS Interface. When an interface error occurs, the error and the phase the error occurred is recorded. Can only be cleared by the Reset Class 1 Diagnostics (IDN 00099).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2 - 0:	Communication phase
Bit 3:	MST Failure
Bit 4:	MDT Failure
Bit 5:	Invalid Phase (Phase > 4)
Bit 6:	Error During Phase Upshift (Invalid Sequence)
Bit 7:	Error During Phase Downshift (Not To Phase 0)
Bit 8:	Phase Switching without Ready Acknowledge
Bit 9:	Switching to Uninitialized Operating Mode
Bit 10 - 15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes		1 byte	Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00015: TELEGRAM TYPE PARAMETER

Selects the Telegram Configuration Type of the AT and the MDT cyclic data. Set by the Master Controller in Phase 2.

TYPE	CONFIGURATION
0	No AT or MDT IDNs
1	IDN 80 (Torque Command) in the MDT
2	IDN 36 (Velocity Command) in the MDT and IDN 40 (Velocity Feedback) in the AT
3	IDN 36 (Velocity Command) in the MDT and IDN 51 (Position Feedback) in the AT
4	IDN 47 (Position Command) in the MDT and IDN 51 (Position Feedback) in the AT
5	IDN 47 (Position Command), IDN 36 (Velocity Command) in the MDT and IDN 51 (Position Feedback), IDN 40 (Velocity Feedback in the AT
6	IDN 36 (Velocity Command) in the MDT
7	User Defined At and MDT (See IDNs 16 and 24)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 7		Phases 2, 3 and 4	Phase 2	0

00016: CONFIGURATION LIST OF AT

List of IDNs that are to be included in the User Defined AT Cyclic Data. Set by the Master Controller in Phase 2. Only Valid if Telegram Type 7 is selected for IDN 00015. (Refer to **IDN 00185** and **IDN 00187**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable	See IDN00185, IDN00187		Phases 2, 3 and 4	Phase 2	0

00017: IDN - LIST OF ALL OPERATION DATA

Returns the list of all valid operation Data IDN's

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00018: IDN - LIST OF OPERATION DATA FOR PHASE 2

Returns the list of all IDN's that must be written by the Master in Phase 2.
IDN's 00001, 00002, 00006, 00007, 00008, 00009, 00010, 00015, 00032 and 00089 must be written.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

00019: IDN - LIST OF OPERATION DATA FOR PHASE 3

Returns the list of all IDN's that must be written by the Master in Phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

00021: IDN - LIST OF INVALID OPERATION DATA FOR PHASE 2

Returns the list of all operation Data IDN's for Phase 2 that is considered invalid by the drive and will need to be written before switchover to phase 3 can be made.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

00022: IDN - LIST OF INVALID OPERATION DATA FOR PHASE 3

Returns the list of all operation Data IDN's for Phase 3 that is considered invalid by the drive and will need to be written before switchover to phase 4 can be made.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

00024: CONFIGURATION LIST OF MDT

List of IDNs that are to be included in the User Defined MDT Cyclic Data. Set by the Master Controller in Phase 2. Only Valid if Telegram Type 7 is selected for IDN 00015. (Refer to **IDN 00186** and **IDN 00188**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable	See IDN00186, IDN00188		Phases 2, 3 and 4	Phase 2	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00025: IDN - LIST OF ALL PROCEDURE COMMANDS

Returns the list of all valid Procedure Command IDN's on drive.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

00028: MST ERROR COUNTER

The MST error counter counts all invalid MST's in Communication Phase 3 and 4. In the case where more than 2 consecutive MST's are invalid, only the first two are counted. The MST error counter counts up to a maximum of 2^{16} -1. This means that if a value of 65535 is set in the counter, there may have been a noisy transmission over a long period of time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes			Phases 2, 3 and 4	None	0

00029: MDT ERROR COUNTER

The MDT error counter counts all invalid MDT's in Communication Phase 3 and 4. In the case where more than 2 consecutive MDT's are invalid, only the first two are counted. The MDT error counter counts up to a maximum of 2^{16} -1. This means that if a value of 65535 is set in the counter, there may have been a noisy transmission over a long period of time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes			Phases 2, 3 and 4	None	0

00030: MANUFACTURER VERSION

Identifies the current software version number in the drive.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Text	Variable			Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00032: PRIMARY OPERATION MODE

The drive operation mode defined by this ID Number becomes active when the Primary Operation mode is set in the Control word of the MDT. Must be configured in phase 2.

VALUES	VALID MODES
0	No Command Mode
1	Torque Control Mode using Cyclic command values
2	Velocity Control Mode using Cyclic command values
3	Position Control using Cyclic command values
16385	Torque Control ignoring Cyclic command values
16386	Velocity Control ignoring Cyclic command values

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2	0

00033 SECONDARY OPERATION MODE 1

The drive operation mode defined by this ID Number becomes active when the Secondary Operation mode 1 is set in the Control word of the MDT. Must be configured in phase 2.

VALUES	VALID MODES
0	No Command Mode
1	Torque Control Mode using Cyclic command values
2	Velocity Control Mode using Cyclic command values
3	Position Control using Cyclic command values
16385	Torque Control ignoring Cyclic command values
16386	Velocity Control ignoring Cyclic command values

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00034: SECONDARY OPERATION MODE 2

The drive operation mode defined by this ID Number becomes active when the Secondary Operation mode 2 is set in the Control word of the MDT. Must be configured in phase 2.

VALUES	VALID MODES
0	No Command Mode
1	Torque Control Mode using Cyclic command values
2	Velocity Control Mode using Cyclic command values
3	Position Control using Cyclic command values
16385	Torque Control ignoring Cyclic command values
16386	Velocity Control ignoring Cyclic command values

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2	0

00035: SECONDARY OPERATION MODE 3

The drive operation mode defined by this ID Number becomes active when the Secondary Operation mode 3 is set in the Control word of the MDT. Must be configured in phase 2.

VALUES	VALID MODES
0	No Command Mode
1	Torque Control Mode using Cyclic command values
2	Velocity Control Mode using Cyclic command values
3	Position Control using Cyclic command values
16385	Torque Control ignoring Cyclic command values
16386	Velocity Control ignoring Cyclic command values

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2	0

00036: VELOCITY COMMAND VALUE

In the velocity control-operating mode in the drive, the control unit transfers the velocity command values to the drive.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	-32768 - +32768	32768bits = 6000RPM	Phases 2, 3 and 4	Phase 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00040: VELOCITY FEEDBACK VALUE

The velocity feedback value is transferred from the drive to the control unit in order to allow the control unit to periodically display the velocity.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes		32768bits = 6000RPM	Phases 2, 3 and 4	None	

00041: HOMING VELOCITY

The homing velocity is used during the procedure command 'drive controlled homing' (IDN 148) when activated. The drive performs its own homing control.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	0 - +32768	32768bits = 6000RPM	Phases 2, 3 and 4	Phase 4	0

00042: HOMING ACCELERATION

The homing acceleration is needed by the drive if the procedure command 'drive controlled homing' (IDN 148) is activated.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0 - 25000.000	rad/sec^2	Phases 2, 3 and 4	Phase 4	0

00043: VELOCITY POLARITY PARAMETER

This parameter is used to switch polarities of velocity data for specific applications. Polarities are not switched internally but externally (on the input and output) of a closed loop system. The motor shaft turns clockwise when there is a positive velocity command difference and no inversion is programmed (see **Figure 6.2**).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Velocity command value = 0 - non-inverted = 1 - inverted
Bit 1:	Reserved
Bit 2:	Velocity feedback value = 0 - non-inverted = 1 - inverted
Bit 15 - 3:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)
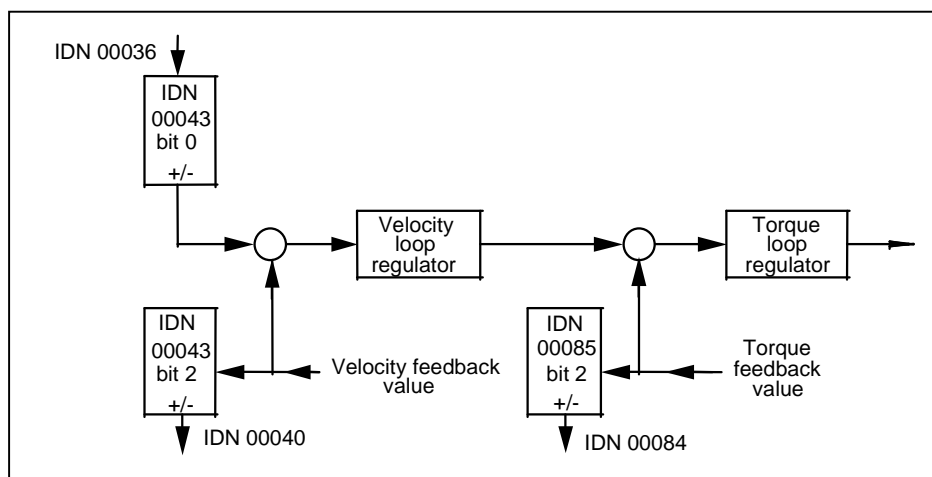
Figure 6.2 - Velocity Polarity Parameter

00044: VELOCITY DATA SCALING TYPE

Defines the scaling option for all velocity data. Only the "No scaling Method is currently supported by the drive.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2-0:	Scaling method 000 - no scaling
All others:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

00047: POSITION COMMAND VALUE

During the position control drive operation mode, the position command values are transferred from the control unit to the drive according to the time pattern of the control unit cycle.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	$-2^{31} - +2^{31} - 1$	1 bit	Phases 2, 3 and 4	Phase 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00051: POSITION FEEDBACK VALUE 1 (MOTOR FEEDBACK)

The position feedback value 1 is transferred from the drive to the control unit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes		1 bit	Phases 2, 3 and 4	None	

00052: REFERENCE DISTANCE 1

This parameter describes the distance between the machine zero point and the reference point related to the motor feedback. After the homing procedure, the position feedback value 1 is calculated by:
- reference distance 1;

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1	1 bit	Phases 2, 3 and 4	Phases 2, 3 and 4	0

00053: POSITION FEEDBACK VALUE 2

The position feedback value 2 is transferred from the drive to the control unit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes		1 bit	Phases 2, 3 and 4	None	

00055: POSITION POLARITY PARAMETERS

This parameter is used to switch polarities of reported position data for specific applications. Polarities are switched outside (i.e. on the input and output) of a closed loop system. The motor shaft turns clockwise (when viewed from the output shaft) when there is a positive position command difference and no inversion is programmed (see **Figure 6.3**).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Position command value 0 - Non-inverted 1 - Inverted
Bit 1:	Reserved
Bit 2:	Position feedback value 1 0 - Non-inverted 1 - Inverted
Bit 3:	Position feedback value 2 0 - Non-inverted 1 - Inverted
Bit 4-15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0
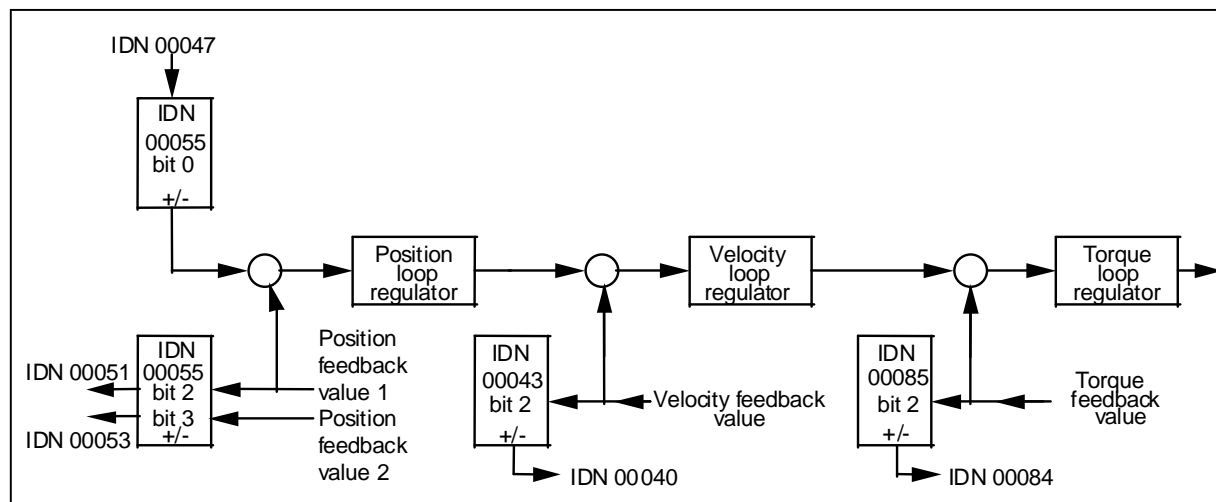
Figure 6.3 - Position Polarity Parameter

00057: POSITION WINDOW

When the difference between the position command value and the position feedback value is within the range of the position window, then the drive sets the status "in position" in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	$0 - +2^{31} - 1$	1 bit	Phases 2, 3 and 4	Phases 2, 3 and 4	$-2^{31} - 1$

00076: POSITION DATA SCALING TYPE

Defines the scaling option for all position data. Only the "No scaling" method is currently supported by the drive.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2-0:	Scaling method 000 - no scaling
All others:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00080: TORQUE COMMAND VALUE

During the torque control operation mode of the drive, torque command values are transferred from the control unit to the drive. This IDN is scaled as a percentage of the drive or motor's peak torque, whichever is less.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	-100.00 - +100.00	0.01%	Phases 2, 3 and 4	Phase 4	0

00082: POSITIVE TORQUE LIMIT

The positive torque limit value limits the maximum torque in the positive direction. If the torque limit is exceeded, the drive sets the status $T >= T_{limit}$ in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	0.00 - 100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4	100.00

00083: NEGATIVE TORQUE LIMIT

The negative torque limit value limits the maximum torque in the negative direction. If the torque limit is exceeded, the drive sets the status $T >= T_{limit}$ in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	0.00 - 100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4	-100.00 ?

00084: TORQUE FEEDBACK VALUE

The torque feedback value is transferred from the drive to the control unit. This IDN is scaled as a percentage of the drive or motor's peak torque, whichever is less.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes		0.01%	Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00085: TORQUE POLARITY PARAMETER

This parameter is used to switch polarities of reported torque data for specific applications. Polarities are not switched internally but externally (on the input and output) of a closed loop system. The motor shaft turns clockwise when there is a positive torque command difference and no inversion (see **Figure 6.4**).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Torque command value 0 - Non-inverted 1 - Inverted
Bit 1:	Reserved
Bit 2:	Torque feedback value 0 - Non-inverted 1 - Inverted
Bit 15-3:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0
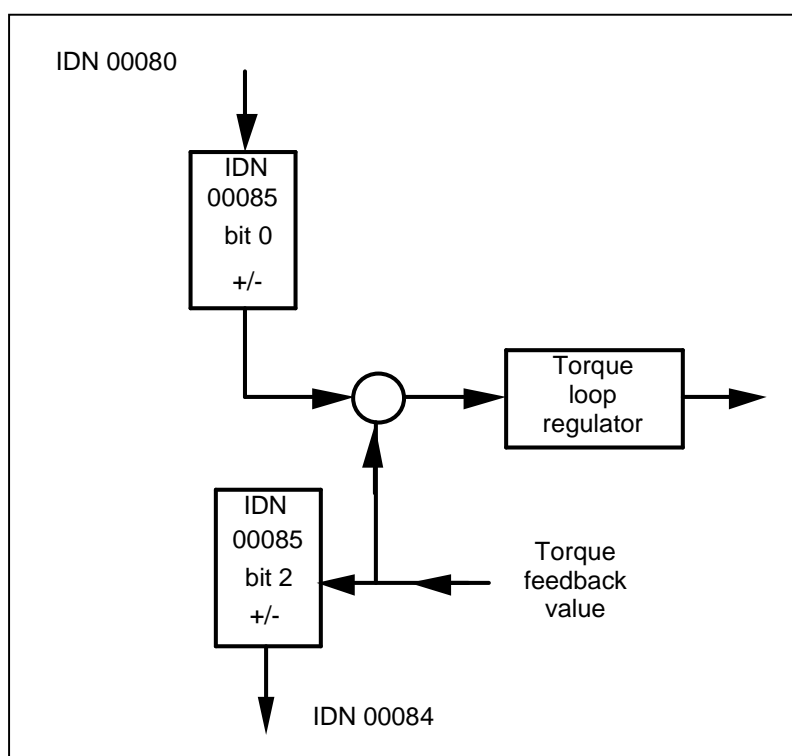
Figure 6.4 - Torque Polarity Parameter

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00086: TORQUE DATA SCALING TYPE

Defines the scaling option for all torque data. Only the "Percentage Scaling" method is currently supported by the drive.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2-0:	Scaling method 000 - Percentage scaling
Bit 3-15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

00088: RECEIVE TO RECEIVE RECOVERY TIME (t_{mtsy})

Recovery time of the slave after reception of a MDT to switch over to receive the next MST. The master reads this time during CP_2 to ensure that the interval will be sufficient between the end of the MDT and the beginning of the MST.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		1 μs	Phases 2, 3 and 4	None	

00089: MDT TRANSMISSION STARTING TIME (t_2)

The MDT transmission starting time determines when the master shall send its MDT during CP_3 and CP_4, following the MST. This parameter is transferred by the master to the slave during CP_2 and becomes active during CP_3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal Number	2 bytes	1 - 5000	1 μs	Phases 2, 3 and 4	Phase 2	0 ?

00090: COMMAND VALUE PROCEEDING TIME (t_{mtsg})

The time required by the slave to make command values available for a drive after receipt of a MDT. This time is read by the master during CP_2 in order to calculate correctly the command value valid time t_3 (IDN 00008).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		1 μs	Phases 2, 3 and 4	None	1

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00091: BIPOLAR VELOCITY LIMIT VALUE

The bipolar velocity limit value describes the maximum allowable velocity in both directions. If the velocity limit value is exceeded, the drive responds by setting the status '$n_{command} > n_{limit}$' in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	0 - 32768	32768 bits = 6000 RPM	Phases 2, 3 and 4	Phases 2, 3 and 4	32768

00092: BIPOLAR TORQUE LIMIT VALUE

The bipolar torque limit value limits the maximum torque symmetrically in both directions. If the torque limit value is exceeded, the drive sets the status '$T \geq T_{limit}$' in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	0 - +100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4	100.00

00095: DIAGNOSTIC MESSAGE

Not currently supported at this time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Text	Variable			Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00096:   SLAVE ARRANGEMENT (SLKN)

During initialization, the master needs to recognize which physical slaves and their associated drives are present in order to optimize the automatic timeslot computation. The master can request this information from the drives during CP$_2$. By this entry the master recognizes other drives which belong to the same physical slave. Valid drive addresses are all decimal values from 1 to 254, in accordance with hexadecimal values $(01)_H$ through $(FE)_H$.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes			Phases 2, 3 and 4	None	

SLKN:

Since each Emerald Drive is configured with one drive per slave, then "Next Drives Address" = "Drive Address".

└ ┴ Next Drives Address (1 through 255)
└ Drive Address (1 through 255)
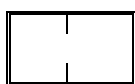
Example:

A drive with an address of "03" has a value of:

03   03
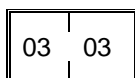
00097:   MASK CLASS 2 DIAGNOSTIC

By means of this mask, warnings in class 2 diagnostic can be masked with respect to their effect on the change bit in drive status. When changing masked warnings, the change bit for class 2 diagnostic is not set in the drive status. The mask does not affect the operation data of class 2 diagnostic (see **IDN 00012**). Setting a bit to 0 masks the effects of the correspond C2D bit on the Class 2 diagnostic change bit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00098: MASK CLASS 3 DIAGNOSTIC

By means of this mask, condition flags in C3D can be masked with respect to their effect on the change bit in drive status. When masked condition flags change, the change bit for C3D is not set in the drive status. The mask does not affect the operation data of C3D (see **IDN 00013**). Setting a bit to 0 masks the effects of the correspond C3D bit on the Class 3 diagnostic change bit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

00099: RESET CLASS 1 DIAGNOSTIC

When this procedure command is received by the drive via the service channel and no error exists, C1D, the interface status, the manufacturer's C1D, the drive shutdown error (drive status bit 13), and the drive shutdown mechanism in the drive are all reset (see **IDN 00011, IDN 00014, and IDN 00129**).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

00100: VELOCITY LOOP PROPORTIONAL GAIN

Sets the proportional gain for the velocity loop controller.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0.000 - 65.535	0.001 Amp/(rad/sec)	Phases 2, 3 and 4	Phases 2, 3 and 4	0.400

00101: VELOCITY LOOP INTEGRAL ACTION TIME

Sets the integral time constant for the velocity loop controller.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0.0 - 6553.5	0.1 msec	Phases 2, 3 and 4	Phases 2, 3 and 4	0.0

00102: VELOCITY LOOP DIFFERENTIAL TIME

Sets the derivative time for the velocity loop controller.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0.0 - 6553.5	0.1 msec	Phases 2, 3 and 4	Phases 2, 3 and 4	0.0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00104: POSITION LOOP K$_V$ - FACTOR

The K_V-factor determines the gain of the position loop regulator throughout the entire velocity range.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0.0 - 6553.5	0.1 (rad/sec)/rad	Phases 2, 3 and 4	Phases 2, 3 and 4	30.0

00105: POSITION LOOP INTEGRAL ACTION TIME

Sets the integral time constant for the postion loop controller.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0.0 - 6553.5	0.1 msec	Phases 2, 3 and 4	Phases 2, 3 and 4	0.0

00106: CURRENT LOOP PROPORTIONAL GAIN 1

Sets the proportional gain for the torque/force-producing current loop.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0.000 - 100.000	0.001 V/A	Phases 2, 3 and 4	Phases 2, 3 and 4	0.0

00107: CURRENT LOOP INTEGRAL ACTION TIME 1

Sets the integral time constant for the torque/force-producing current loop.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	1 μsec	Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00109: MOTOR PEAK CURRENT

If the motor peak current is less than that of the amplifier, the amplifier is automatically limited to the level of the motor peak current. The setting range for this IDN is dependant on drive size and PWM frequency.

Emerald Driver	ESD-5		ESD-10		ESD-20		ESD-40		ESD-60	
PWM Frequency	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz
Min. Setting	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak
Max. Setting	17.675 A peak	14.140 A peak	35.350 A peak	28.280 A peak	70.700 A peak	56.560 A peak	141.40 A peak	113.12 A peak	169.68 A peak	135.744 A peak

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	See table above	0.001 A	Phases 2, 3 and 4	Phases 2 and 3	0.000

00110: AMPLIFIER PEAK CURRENT

The amplifier peak current is limited by the hardware, which means that the current for the maximum attainable torque limit value is fixed as well.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes		0.001 A peak	Phases 2, 3 and 4	None	Depends on drive size

00112: AMPLIFIER RATED CURRENT

The amplifier rated current is equal to the allowable continuous current of the drive unit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes		0.001 A peak	Phases 2, 3 and 4	None	Depends on drive size

00113: MAXIMUM MOTOR SPEED

The maximum motor speed is listed in the motor spec sheet provided by the manufacturer.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0.0000 - 6000.0000	0.0001 RPM	Phases 2, 3 and 4	Phases 2 and 3	0.0000

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00119: CURRENT LOOP PROPORTIONAL GAIN 2

Sets the proportional gain for the flux-producing current loop.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0.000 - 100.000	0.001 V/A	Phases 2, 3 and 4	Phases 2, 3 and 4	0.000

00120: CURRENT LOOP INTEGRAL ACTION TIME 2

Sets the integral time constant for the flux-producing current loop.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	1 μsec	Phases 2, 3 and 4	Phases 2, 3 and 4	0

00124: STANDSTILL WINDOW

The standstill window describes the amount of the deviation of the velocity from 0. If the velocity feedback value is within the standstill window the drive sets the status $n_{feedback} = 0$ in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0 - 32768	32768 bits = 6000 RPM	Phases 2, 3 and 4	Phases 2, 3 and 4	0

00125: VELOCITY THRESHOLD (n_x)

If the velocity feedback value falls below the velocity threshold n_X, the drive sets the status '$n_{feedback} < n_X$' in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0 - 32768	32768 bits = 6000 RPM	Phases 2, 3 and 4	Phases 2, 3 and 4	32768

00126: TORQUE THRESHOLD (T_X)

If the torque feedback value exceeds the torque threshold T_X, the drive sets the status '$T \geq T_X$' in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - +100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00127: CP$_3$ TRANSITION CHECK

The master uses this procedure command to instruct the slave to check that all necessary parameters have been transferred for CP$_3$. Otherwise, this procedure command results in an error (see **IDN 00021**). After the procedure command is performed correctly, the control unit has to cancel the procedure command. The control unit can then activate CP$_3$ in the MST.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 2	0

00128: CP$_4$ TRANSITION CHECK

The master uses this procedure command to instruct the slave to check that all necessary parameters have been transferred for CP$_4$. Otherwise, this procedure command results in an error (see **IDN 00022**). After the procedure command is performed correctly, the control unit has to cancel the procedure command. The control unit can then activate CP$_4$ in the MST.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 3	0

00129: MANUFACTURER CLASS 1 DIAGNOSTIC

If an error is set in the manufacturer class 1 diagnostic, the manufacturer-specific error bit in class 1 diagnostic (see **IDN 00011**) is set as well. The drive cancels the manufacturer-specific error and resets to '0' only if the error in manufacturer class 1 diagnostic has been eliminated and on receiving the command 'reset class 1 diagnostic' (see **IDN 00099**) via the service channel.

Bits supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Sercos synchronization error
Bit 1:	Non-volatile parameter loss
Bit 2:	I/O CAN network error
Bit 3:	Regen resistor error (Open or Over-Temperature)
Bit 4:	Power board not recognized
Bit 5:	Power module fault
Bit 6:	Cycle of power required
Bit 7 - 15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00130: PROBE VALUE 1 POSITIVE EDGE

Based on the configure Probe Feedback Source (IDN 33200) the drive stores position feedback value in the measuring cycle in this parameter following the positive edge of the input signal of probe 1 (see **IDN 00401**). This allows the control unit to read 'probe value 1 positive edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes			Phases 2, 3 and 4	None	

00131: PROBE VALUE 1 NEGATIVE EDGE

Based on the configure Probe Feedback Source (IDN 33200) the drive stores position feedback value in the measuring cycle in this parameter following the negative edge of the input signal of probe 1 (see **IDN 00401**). This allows the control unit to read 'probe value 1 negative edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes			Phases 2, 3 and 4	None	

00132: PROBE VALUE 2 POSITIVE EDGE

Based on the configured Probe Feedback Source (IDN 33200) the drive stores position feedback value in the measuring cycle in this parameter following the positive edge of the input signal of probe 2 (see **IDN 00402**). This allows the control unit to read 'probe value 2 positive edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes			Phases 2, 3 and 4	None	

00133: PROBE VALUE 2 NEGATIVE EDGE

Based on the configured Probe Feedback Source (IDN 33200) the drive stores position feedback value in the measuring cycle in this parameter following the negative edge of the input signal of probe 2 (see **IDN 00402**). This allows the control unit to read 'probe value 2 negative edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes			Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00134: MASTER CONTROL WORD

Allows reading of the master control word on the control unit screen, via the service channel. (This can be useful during start-up and error recovery.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00135: DRIVE STATUS WORD

Allows reading of the drive status word on the control unit screen, via the service channel. (This can be useful during start-up and error recovery.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00138: BIPOLAR ACCELERATION LIMIT VALUE

The bipolar acceleration parameter limits the maximum acceleration ability of the drive symmetrically to the programmed value in both directions.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0 - 25000.000	rad/sec/sec	Phases 2, 3 and 4	Phases 2, 3 and 4	25000.000

00140: CONTROLLER TYPE

The operation data of the controller type contains the name of the company and the manufacturer controller type.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Text	Variable			Phases 2, 3 and 4	None	

00142: APPLICATION TYPE

The operation data of the application type contains the type of the drive application (e.g., main spindle drive, round axis).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Text	Variable			Phases 2, 3 and 4	Phases 2, 3 and 4	Not defined

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00143: SYSTEM INTERFACE VERSION

The operation data of SYSTEM interface version contains the version of the SYSTEM Interface specification.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Text	Variable			Phases 2, 3 and 4	None	V02.04

00147: HOMING PARAMETER

This parameter is used to setup the Homing Procedure.

Structure of homing parameter:
Bit 0: Homing direction
        0 - positive: increasing position values
        1 - negative: decreasing position values
Bit 1: Position feedback marker pulse
        0 - first marker pulse after the positive edge of the home switch (S-0-0400)
        1 - first marker pulse after the negative edge of the home switch (S-0-0400)
Bit 2: Home switch (S-0-0400)
        0 - connected to the control unit **(Not Supported)**
        1 - connected to the drive
Bit 3: Homing
        0 - using motor feedback
        1 - using external feedback **(Not Supported)**
Bit 4: **(Not Supported)**
Bit 5: Evaluation of home switch
        0 - home switch is evaluated
        1 - home switch is not evaluated
Bit 6 Evaluation of position feedback marker pulse
        0 - marker pulse is evaluated
        1 - marker pulse is not evaluated
Bits 7-15: **(Not Supported)**

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00148: DRIVE CONTROLLED HOMING PROCEDURE COMMAND

When the Master sets and enables the Drive Controlled homing procedure command, the drive automatically activates the drive internal position control and accelerates to the homing velocity (S-0-0041) taking the Homing acceleration (S-0-0042) into account. The drive resets the bit "position feedback value status" (S-0-0403). Further options for the homing procedure are programmed in the "homing parameter" (S-0-0147). All changes of the cyclic command values are ignored as long as the procedure command is activated. After passing over the reference marker pulse, the drive decelerates to standstill, taking the homing acceleration into account. The procedure command "drive controlled homing" is successfully completed when the drive has stopped and the position feedback value is referred to the reference point of the machine. The drive announces this by setting the bit "position feedback value status" (S-0-0403). The drive internally calculates the commanded position value (S-0-0047) relationship to the reference mark and adjusts S-0-0047 accordingly. The control unit must then either read the "position command value" (S-0-0047) of the drive via the service channel and resets it's position command value to this position command value, or the control sets its position command off the reference distance (S-0-0052), (S-0-0147 must be set to 1). Afterwards, the control unit cancels the procedure command and the drive once again follows the command values of the control unit. An interrupt of this procedure command will result in the position feedback value not being referenced to the position feedback reference mark. Also the 'position feedback status value' bit will not be set. When an error of C1D occurs, the procedure command results in an error in the procedure command acknowledgment.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

00157: VELOCITY WINDOW

The velocity window" relates the current velocity to the velocity command value (IDN 00036). If the current velocity feedback value falls within the calculated velocity window, the drive sets the status 'n feedback = n command' in C3D (IDN 00013)·

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0 - 32768	32768 bits = 6000 RPM	Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)
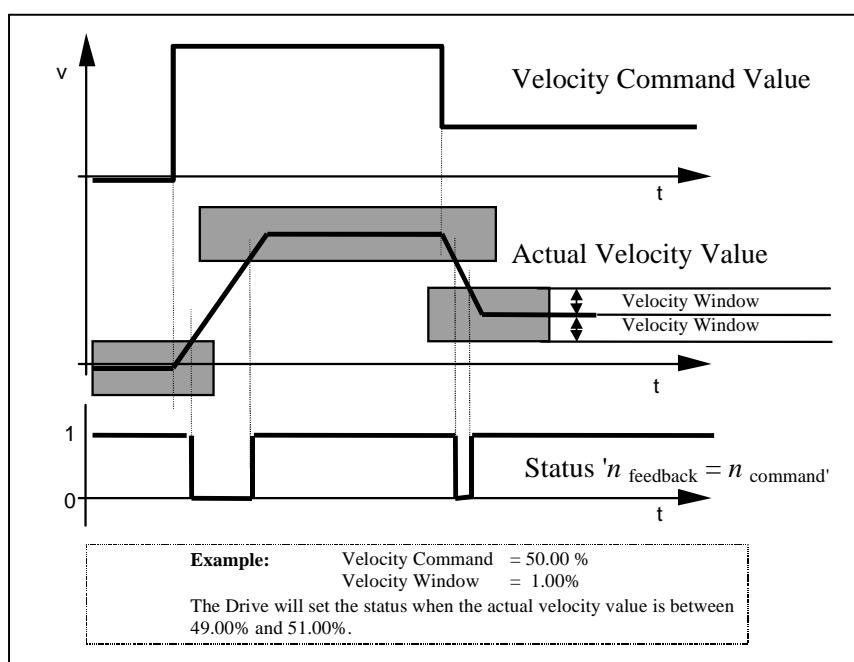
Figure 6.5 - Example of Velocity Window

00159: MONITORING WINDOW

By means of the monitoring window, the maximum position deviation, as referenced to the active actual position value, can be defined for the position feedback value. When the position error value exceeds the maximum position window value for a time longer than the following error delay time (IDN 33800), the drive sets an error for excessive position deviation in C1D (IDN 00011).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	$0 - +2^{31} - 1$		Phases 2, 3 and 4	Phases 2, 3 and 4	$-2^{31} - 1$

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00160: ACCELERATION DATA SCALING TYPE

Structure of the acceleration data scaling type:
Bits 2-0: Scaling method

        000 - no scaling **(Not Supported)**

        001 - linear scaling **(Not Supported)**

        010 - rotational scaling

        011 - ramp time **(Not Supported)**

Bit 3:

        0 - preferred scaling

        1 - parameter scaling **(Not Supported)**

Bit 4: Units for linear scaling

        0 - meters [m] **(Not Supported)**

        (1 - inches [in]) additional **(Not Supported)**

Bit 4: Units for rotational scaling

        0 - radian [rad]

        1 - (reserved)

Bit 5: Time units

        0 - seconds [s]

        1 - (reserved)

Bit 6: Data reference

        0 - at the motor shaft

        1 - at the load **(Not Supported)**

(All other bits are reserved)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	2

00161: ACCELERATION DATA SCALING FACTOR

This parameter defines the scaling factor for all acceleration data in a drive. This parameter is read only and is always a value of 1.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes			Phases 2, 3 and 4	None	1

00162: ACCELERATION DATA SCALING EXPONENT

This parameter defines the scaling exponent for all acceleration data in a drive. This parameter is read only and is always a value of -3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes			Phases 2, 3 and 4	None	-3

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00169: PROBE CONTROL PARAMETER

This parameter fixes which probes and which edges are activated for the probing cycle procedure command. Only 1 edge (either rising or falling) can be selected for each probe input.

Bits supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	0 - positive edge is not active 1 - positive edge is active
Bit 1:	0 - negative edge is not active 1 - negative edge is active
Bit 2:	0 - positive edge is not active 1 - positive edge is active
Bit 3:	0 - negative edge is not active 1 - negative edge is active
Bit 4 -15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

00170: PROBING CYCLE PROCEDURE COMMAND

When the master sets and enables the probing cycle procedure command, the drive reacts on the following parameters:

- Probe 1/2 enable (IDN 00405/00406); and
- Probe 1/2 (IDN 00401/00402) as programmed in the probe control parameter (IDN 00169).

While the procedure command is activated the control unit can start multiple measurements.

If the control unit does not want any more measurements the control unit cancels the procedure command.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

00179: PROBE STATUS

Indicates the latch status of Probe1 and Probe 2

Bits supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	0 - positive edge is not latched 1 - positive edge is latched
Bit 1:	0 - negative edge is not latched 1 - negative edge is latched
Bit 2:	0 - positive edge is not latched 1 - positive edge is latched
Bit 3:	0 - negative edge is not latched 1 - negative edge is latched
Bit 4 -15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00185: LENGTH OF THE CONFIGURABLE DATA RECORD IN THE AT

This parameter indicates the maximum length, in bytes, which can be processed in the configurable data record of the AT.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		1 Byte	Phases 2, 3 and 4	None	36

00186: LENGTH OF THE CONFIGURABLE DATA RECORD IN THE MDT

This parameter indicates the maximum length, in bytes, which can be processed in the configurable data record of the MDT.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		1 Byte	Phases 2, 3 and 4	None	36

00187: IDN-LIST OF CONFIGURABLE DATA IN THE AT

In this list the IDNs of operation data that can be processed by the drive cyclically as feedback values.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00188: IDN-LIST OF CONFIGURABLE DATA IN THE MDT

In this list the IDNs of operation data that can be processed by the drive cyclically as command values.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable			Phases 2, 3 and 4	None	

00189: FOLLOWING DISTANCE

The drive uses the operation data of this IDN to store the distance between position command value and the position feedback value 1. Calculation of the following distance:
following distance = position command value - position feedback value 1

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes			Phases 2, 3 and 4	None	

00196: MOTOR RATED CURRENT

The motor rated current is the current at which the motor produces the rated torque according to the motor spec sheet. The setting range for this IDN is dependant on drive size and PWM frequency.

Emerald Driver	ESD-5		ESD-10		ESD-20		ESD-40		ESD-60	
PWM Frequency	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz	8 KHz	16 KHz
Min. Setting	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak	0 A peak
Max. Setting	7.070 A peak	5.656 A peak	14.140 A peak	11.312 A peak	28.280 A peak	22.624 A peak	56.560 A peak	45.248 A peak	84.840 A peak	67.872 A peak

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	See table above	0.001 A	Phases 2, 3 and 4	Phases 2 and 3	0

00200: AMPLIFIER WARNING TEMPERATURE

When the amplifier temperature exceeds the amplifier warning temperature value, the drive sets the warning bit for amplifier over temperature in C2D (IDN 12).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0.0 - 105.0	IDN 208	Phases 2, 3 and 4	Phases 2, 3 and 4	105.0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00203: AMPLIFIER SHUTDOWN TEMPERATURE

When the amplifier temperature exceeds the amplifier shutdown temperature value, the drive sets the bit for amplifier over temperature shutdown in C1D (IDN 11).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		IDN 208	Phases 2, 3 and 4	None	105.0

00206: DRIVE ON DELAY TIME

After torque is activated (bit 14, drive status is set) "drive on delay time" is started. The drive follows the command values after the "drive on delay time" has elapsed.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 6553.6	0.1 ms	Phases 2, 3 and 4	Phases 2, 3 and 4	0

00207: DRIVE OFF DELAY TIME

After "drive off" (bit 15 of the master control word) is reset and n_{min} is reached, the torque remains activated in the drive until this waiting time is elapsed.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 6553.6	0.1 ms	Phases 2, 3 and 4	Phases 2, 3 and 4	0

00208: TEMPERATURE DATA SCALING TYPE

This scaling type parameter determines whether temperature is used in units of °C or F. Temperature scaling is 0,1 °C or 0,1 F.

Structure of temperature data scaling type:
Bit 0:
        0 - entry in 0,1 °C
        1 - entry in 0,1 F **(Not Supported)**
(All other bits are reserved)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00273: MAXIMUM DRIVE OFF DELAY TIME

After "drive off" (bit 15, control word) is reset, the "maximum drive off delay time" is started. After the "maximum drive off delay time" is elapsed, the locking of the brake is initiated and the torque is disabled.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 6553.6	0.1 ms	Phases 2, 3 and 4	Phases 2, 3 and 4	0.0

00295: DRIVE ENABLE DELAY TIME

When "drive enable" is set (bits 14, control word) the "drive enable delay time" is started. Motor current (torque) will first be activated after this time delay. The enable delay is required at use of a contactor in the motor cable.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 6553.6	0.1 ms	Phases 2, 3 and 4	Phases 2, 3 and 4	0

00296: VELOCITY FEED FORWARD GAIN

Velocity feed forward serves to reduce the velocity-dependent following error.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	0.0 - 200.0	0.1%	Phases 2, 3 and 4	Phases 2, 3 and 4	0.0

00300: REAL-TIME CONTROL BIT 1

Contains the state of the control signal defined in IDN 00301 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00301: ALLOCATION OF REAL-TIME CONTROL BIT 1

Assigns a control signal to the real-time control bit 1 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time control bit 1.
Valid IDN's are (IDN 00405, 00406).

Writing a value of zero disables Real Time Control Bit 1. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00302: REAL-TIME CONTROL BIT 2

Contains the state of the control signal defined in IDN 00303 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

00303: ALLOCATION OF REAL-TIME CONTROL BIT 2

Assigns a control signal to the real-time control bit 2 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time control bit 2.
Valid IDN's are (IDN 00405, 00406).

Writing a value of zero disables Real Time Control Bit 2. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

00304: REAL-TIME STATUS BIT 1

Contains the state of the status signal defined in IDN 00305 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

00305: ALLOCATION OF REAL-TIME STATUS BIT 1

Assigns a control signal to the real-time status bit 1 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time status bit 1.
Valid IDN's are (IDN 00401, 00402, 00409, 00410, 00411, 00412).

Writing a value of zero disables real time status bit 1. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00306: REAL-TIME STATUS BIT 2

Contains the state of the status signal defined in IDN 00307 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00307: ALLOCATION OF REAL-TIME STATUS BIT 2

Assigns a control signal to the real-time status bit 2 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time status bit 2.
Valid IDN's are (IDN 00401, 00402, 00409, 00410, 00411, 00412).

Writing a value of zero disables real time status bit 2. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

00348: ACCELERATION FEED FORWARD GAIN

Acceleration feed forward serves to reduce acceleration / deceleration-dependent following error.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0.0 - 6553.5	0.1 ($mAsec^2$/rad)	Phases 2, 3 and 4	Phases 2, 3 and 4	0.0

00380: DC BUS VOLTAGE

The drive's DC (intermediate) bus voltage value is placed in this parameter.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		1 volt	Phases 2, 3 and 4	None	

00384: AMPLIFIER TEMPERATURE

The drive places the measured (actual) amplifier temperature (output stage) in this parameter.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		IDN 208	Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00400: HOME SWITCH

This parameter is used to assign an IDN to the home switch (external signal).

Structure of home switch:
Bit 0 = 0: inactive switch
        1: active switch

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00401: PROBE 1

Contains the state of the Probe 1 Input in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00402: PROBE 2

Contains the state of the Probe 2 Input in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00403: POSITION FEEDBACK VALUE STATUS

When the drive switches the position feedback values to the coordinates referred to the machine zero point the drive sets bit 0 of this parameter in order to inform the control unit that all actual position values are based on the zero point of the machine. Bit 0 is reset when the procedure command "drive controlled homing procedure" (IDN 148) is started or when the drive loses its reference to the zero point of the machine. Bit 0 is defined for operation data only.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00405: PROBE 1 ENABLE

Probe 1 enable is checked by the drive only if the procedure commands "probing cycle" (IDN 00170) is active. For a new probing cycle with the same edge of probe 1 the control unit has to reset probe 1 enable to "0" and set it to "1". (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

00406: PROBE 2 ENABLE

Probe 2 enable is checked by the drive only if the procedures command "probing cycle" (IDN 00170) is active. For a new probing cycle with the same edge of probe 2 the control unit has to reset probe 2 enable to "0" and set it to "1". (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

00409: PROBE 1 POSITIVE LATCHED

This parameter is used to assign an IDN to probe 1 positive latched. This allows assigning the status "probe 1 positive latched" to a real-time status bit (see **IDN 00305**). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 1 enable" (IDN 00405) is set to 1 and the positive edge of "probe 1" (IDN 00401) is announced. Simultaneously the drive stores the position feedback value in "probe 1 positive edge" (IDN 00130). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 1 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

00410: PROBE 1 NEGATIVE LATCHED

This parameter is used to assign an IDN to probe 1 negative latched. This allows assigning the status "probe 1 negative latched" to a real-time status bit (see **IDN 00305**). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 1 enable" (IDN 00405) is set to 1 and the negative edge of "probe 1" (IDN 00401) is announced. Simultaneously the drive stores the position feedback value in "probe 1 negative edge" (IDN 00131). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 1 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00411: PROBE 2 POSITIVE LATCHED

This parameter is used to assign an IDN to probe 2 positive latched. This allows assigning the status "probe 2 positive latched" to a real-time status bit (see IDN 00305). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 2 enable" (IDN 00406) is set to 1 and the positive edge of "probe 2" (IDN 00402) is announced. Simultaneously the drive stores the position feedback value in "probe 2 positive edge" (IDN 00132). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 2 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

00412: PROBE 2 NEGATIVE LATCHED

This parameter is used to assign an IDN to probe 2 negative latched. This allows assigning the status "probe 2 negative latched" to a real-time status bit (see **IDN 00305**). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 2 enable" (IDN 00406) is set to 1 and the negative edge of "probe 2" (IDN 00402) is announced. Simultaneously the drive stores the position feedback value in "probe 2 negative edge" (IDN 00133). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 2 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

32769: U CURRENT SENSOR CALIBRATION OFFSET

This IDN is used to set a calibration offset for the U leg current sensor. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	-5000 to +5000	None	Phases 2, 3 and 4	See Above	Factory set

32770: U CURRENT SENSOR CALIBRATION GAIN

This IDN is used to set a calibration gain for the U leg current sensor. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}-1$	None	Phases 2, 3 and 4	See Above	Factory set

32771: V CURRENT SENSOR CALIBRATION OFFSET

This IDN is used to set a calibration offset for the V leg current sensor. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	-5000 to +5000	None	Phases 2, 3 and 4	See Above	

32772: V CURRENT SENSOR CALIBRATION GAIN

This IDN is used to set a calibration gain for the V leg current sensor. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}-1$	None	Phases 2, 3 and 4	See Above	Factory set

32773: U CURRENT SENSOR

This IDN returns the current sensed by the U leg current sensor. The only scaling done on this value is the Calibration Gain and Offset.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes		None	Phases 2, 3 and 4	None	Factory set

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

32774: V CURRENT SENSOR

This IDN returns the current sensed by the V leg current sensor. The only scaling done on this value is the Calibration Gain and Offset.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes		None	Phases 2, 3 and 4	None	

32775: PROCEDURE COMMAND REMOVE CALIBRATION WRITE-PROTECT

Activating this Procedure Command removes the write-protection on the following Calibration IDNs: 32769, 32770, 32771, 32772, 32777, 32778, 32783, 32784, 32785, 32786

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

32776: PROCEDURE COMMAND SAVE CALIBRATION PARAMETERS

Activating this Procedure Command causes all calibration data to be saved into non-volatile memory.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

32777: DC BUS CALIBRATION OFFSET

This IDN is used to set a calibration offset for the DC Bus Voltage measurement. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	-5000 to +5000	None	Phases 2, 3 and 4	See Above	Factory set

32778: DC BUS CALIBRATION GAIN

This IDN is used to set a calibration gain for the DC Bus Voltage measurement. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	None	Phases 2, 3 and 4	See Above	Factory set

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

32783: ANALOG INPUT CALIBRATION OFFSET

This IDN is used to set a calibration offset for the Analog Input. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	-5000 to +5000	None	Phases 2, 3 and 4	See Above	Factory set

32784: ANALOG INPUT CALIBRATION GAIN

This IDN is used to set a calibration gain for the Analog Input. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	None	Phases 2, 3 and 4	See Above	Factory set

32785: W CURRENT SENSOR CALIBRATION OFFSET

This IDN is used to set a calibration offset for the W leg current sensor. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes	-5000 to +5000	None	Phases 2, 3 and 4	See Above	Factory set

32786: W CURRENT SENSOR CALIBRATION GAIN

This IDN is used to set a calibration gain for the W leg current sensor. This IDN is write-protected until Procedure Command Remove Calibration Write-Protect (IDN 32775) is active.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$-1	None	Phases 2, 3 and 4	See Above	Factory set

32787: W CURRENT SENSOR

This IDN returns the current sensed by the W leg current sensor. The only scaling done on this value is the Calibration Gain and Offset.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes		None	Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

32788: CURRENT FAULT FACTOR

This IDN is used to set the peak current fault point. The fault point is set as a percentage of the motor or drive's peak current, whichever is less. The default is 120%.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		1%	Phases 2, 3 and 4	None	120

33000: DIGITAL OUTPUTS 1

The state of the digital outputs on I/O device 1 can be set via this parameter.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2, 3 and 4	0

33001: DIGITAL OUTPUTS 2

The state of the digital outputs on I/O device 2 can be set via this parameter.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2, 3 and 4	0

33200: PROBE SOURCE

This parameter sets which feedback is trapped by the probes.

Bits supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	0 - Probe 1 traps position feedback value 1
	1 - Probe 1 traps position feedback value 2
Bit 1:	0 - Probe 2 traps position feedback value 1
	1 - Probe 2 traps position feedback value 2
Bit 2 -15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 3		Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

33300: I/0 DEVICE 1 CONFIGURATION

This parameter configures I/O device 1. Currently only the ESD-I/O16 device is supported. This device has 16 configurable digital I/O.

Bits supported by drive for ESD-I/O16:

BIT NUMBER	DESCRIPTION
Bit 0 - 15:	0 - Configured as Input 1 - Configured as Output

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2, 3 and 4	0

33301: I/0 DEVICE 2 CONFIGURATION

This parameter configures I/O device 2. Currently only the ESD-I/O16 device is supported. This device has 16 configurable digital I/O.

Bits supported by drive for ESD-I/O16:

BIT NUMBER	DESCRIPTION
Bit 0 - 15:	0 - Configured as Input 1 - Configured as Output

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2, 3 and 4	0

33304: I/O DEVICE 1 TYPE

This parameter sets the expected device type for I/O device 1. Currently only the ESD-I/O16 is supported with a device type of 1.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	1		Phases 2, 3 and 4	Phases 2, 3 and 4	0

33305: I/O DEVICE 2 TYPE

This parameter sets the expected device type for I/O device 2. Currently only the ESD-I/O16 is supported with a device type of 1.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	1		Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

33500: DIGITAL INPUTS 1

Reads the State of the Digital Inputs from I/0 Device 1.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Input 1
Bit 1:	Input 2
Bit 2:	Input 3
Bit 3:	Input 4
Bit 4:	Input 5
Bit 5:	Input 6
Bit 6:	Input 7
Bit 7:	Input 8
Bit 8:	Input 9
Bit 9:	Input 10
Bit 10:	Input 11
Bit 11:	Input 12
Bit 12:	Input 13
Bit 13:	Input 14
Bit 14:	Input 15
Bit 15:	Input 16

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

33501: DIGITAL INPUTS 2

Reads the State of the Digital Inputs from I/0 Device 2.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Input 1
Bit 1:	Input 2
Bit 2:	Input 3
Bit 3:	Input 4
Bit 4:	Input 5
Bit 5:	Input 6
Bit 6:	Input 7
Bit 7:	Input 8
Bit 8:	Input 9
Bit 9:	Input 10
Bit 10:	Input 11
Bit 11:	Input 12
Bit 12:	Input 13
Bit 13:	Input 14
Bit 14:	Input 15
Bit 15:	Input 16

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None	

33600: ANALOG INPUT 1

Read the counts from the Analog Input 1.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes		-2^{15} - $+2^{15} - 1$ = -10V - +10V	Phases 2, 3 and 4	None	

33650: PWM OUTPUT

This parameter sets the duty cycle for the general purpose PWM output. The switching frequency for this output is the same as the motor switching frequency and is set by IDN 33801. The output swings between 0 and +15V.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	0 - 65535 = 0% -100% duty cycle	Phases 2, 3 and 4	None	0

33700: ALARM HISTORY

The drive maintains a list of the last 15 Fault Codes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	Variable 1 byte each			Phases 2, 3 and 4	None	

33701: CURRENT DRIVE FAULT

This IDN returns the fault code of the most recent drive fault. If there are no faults a value of 0 will be returned.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes			Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

33702: CURRENT DRIVE FAULT BITMAP 1

Returns a status bitmap of faults 0 - 31. Some bits are reserved so see **Section 7** for a list of fault codes and their descriptions.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	4 bytes			Phases 2, 3 and 4	None	

33703: CURRENT DRIVE FAULT BITMAP 2

Returns a status bitmap of faults 32 - 63. Some bits are reserved so see **Section 7** for a list of fault codes and their descriptions.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	4 bytes			Phases 2, 3 and 4	None	

33704: CURRENT DRIVE FAULT BITMAP 3

Returns a status bitmap of faults 64 - 95. Some bits are reserved so see **Section 7** for a list of fault codes and their descriptions.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	4 bytes			Phases 2, 3 and 4	None	

33705: CURRENT DRIVE FAULT BITMAP 4

Returns a status bitmap of faults 96 - 127. Some bits are reserved so see **Section 7** for a list of fault codes and their descriptions.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	4 bytes			Phases 2, 3 and 4	None	

33799: CLEAR DRIVE FAULT HISTORY PROCEDURE COMMAND

This procedure command sets all values in the drive fault history (IDN 33700) to zero.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

33800: FOLLOWING ERROR DELAY TIME

This parameter sets a time delay from when the position deviation is outside the monitoring window (IDN 159) and when a fault is triggered.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	1 msec	Phases 2, 3 and 4	Phases 2, 3 and 4	0

33801: PWM FREQUENCY

Sets the PWM switching frequency for the motor and the general purpose PWM output. If this parameter is changed from its current value a Fault 50 will result and the drive's 24V power must be cycled.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	8 or 16	kHz	Phases 2, 3 and 4	Phases 2	Non-volatile

34000: MOTOR CODE

This parameter is used to store a unique code for every motor that IIS has approved to run on the Emerald drive.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2 and 3	0

34003: MOTOR POLES

This parameter sets the number of motor magnetic poles.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	2 - 12		Phases 2, 3 and 4	Phases 2 and 3	4

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34004: FEEDBACK TYPE

This parameter sets the motor feedback type.

Values supported by drive:

VALUE	DESCRIPTION
0	Resolver **(Not Supported)**
1	Incremental Encoder

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 or 1		Phases 2, 3 and 4	Phases 2 and 3	1

34005: RESOLVER CYCLES

Not yet supported.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	1 or 2		Phases 2, 3 and 4	Phases 2 and 3	0

34006: MOTOR FEEDBACK CONFIGURATION

This parameter is used to change the direction of the motor feedback.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Reserved
Bit 1:	0 - Motor Feedback is inverted. 1 - Motor Feedback is not inverted.
Bit 2 - 15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 or 1		Phases 2, 3 and 4	Phases 2 and 3	1

34007: MOTOR RATED SPEED

The rated motor speed is listed in the motor spec sheet provided by the manufacturer.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes	0.0000 - 6000.0000	0.0001 RPM	Phases 2, 3 and 4	Phases 2 and 3	0

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34009: OVERLOAD DELAY TIME

Reserved for future use.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Decimal	2 bytes	0.1 - 6553.5	0.1 ms	Phases 2, 3 and 4	Phases 2 and 3	0

34011: ENCODER LINE COUNT

This parameter sets the encoder line count before quadrature.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535		Phases 2, 3 and 4	Phases 2 and 3	2000

34224: POSITION LOOP DIFFERENTIAL TIME

Sets the derivative time for the position loop controller.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0.0 - 6553.5	0.1 msec	Phases 2, 3 and 4	Phases 2, 3 and 4	0

34243: CURRENT COMMAND (AMPS)

This IDN returns the current loop command value in Amps. This is a read only IDN for display purposes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes		0.001 Amps	Phases 2, 3 and 4	None	

34244: CURRENT FEEDBACK (AMPS)

This IDN returns the current loop feedback value in Amps. This is a read only IDN for display purposes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes		0.001 Amps	Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34245: VELOCITY COMMAND (RPM)

This IDN returns the velocity loop command value in RPM. This is a read only IDN for display purposes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes		1 RPM	Phases 2, 3 and 4	None	

34246: VELOCITY FEEDBACK (RPM)

This IDN returns the velocity loop feedback value in RPM. This is a read only IDN for display purposes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	2 bytes		1 RPM	Phases 2, 3 and 4	None	

34260: MOTOR PHASE ANGLE

This IDN returns the motor's phase angle used for commutation. This is a read only IDN for display purposes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes		0.1 Degree	Phases 2, 3 and 4	None	

34280: CURRENT COMMAND REJECTION FREQUENCY

This parameter sets rejection frequency for a notch filter on the current loop command value.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	50 - 950	1 Hz	Phases 2, 3 and 4	Phases 2, 3 and 4	900

34281: CURRENT COMMAND REJECTION BANDWIDTH

This parameter sets bandwidth for a notch filter on the current loop command value.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 500	1 Hz	Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34282: TUNING PARAMETERS LIST

This IDN returns a list of all available control loop-tuning IDNs.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable 2 byte each			Phases 2, 3 and 4	None	

34283: MOTOR PARAMETER LIST

This IDN returns a list of all available motor specific IDNs.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable 2 byte each			Phases 2, 3 and 4	None	

34284: MONITOR PARAMETERS LIST

This IDN returns a list of IDNs that could be useful for monitor or display purposes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable 2 byte each			Phases 2, 3 and 4	None	

34285: MONITOR I/O LIST

This IDN returns a list of I/O related IDNs that could be useful for monitor or display purposes.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable 2 byte each			Phases 2, 3 and 4	None	

34286: MONITOR ALARM LIST

This IDN returns a list of IDNs that provide diagnostic or fault code information.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	Variable 2 byte each			Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34287: READ ERROR

This IDN returns error information when reading/writing IDNs over RS-232 or USB. The structure of this IDN is as follows:

BYTE NUMBER	DESCRIPTION
Byte 0 - 1	Number of bytes returned. Always 4.
Byte 2 - 3	Maximum bytes available. Always 4.
Byte 4 - 5	IDN Number.
Byte 6 - 7	Element Number.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	Variable 2 byte each			Phases 2, 3 and 4	None	

34288: POWER BOARD ID

This IDN returns the ID of the power stage.

POWER BOARED ID	DRIVE SIZE
1	ESD-5
2	ESD-10
4	ESD-20
8	ESD-40
16	ESD-60
All Other IDs	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes			Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34300: AUXILIARY ENCODER FEATURES SETUP

This IDN enables/disables special features of the Emerald Drive's Auxiliary Encoder.

BYTE NUMBER	DESCRIPTION
Bit 0:	Wait for marker
Bits 1 - 15:	Reserved

Setting the bit "Wait for marker" will zero the Auxiliary Encoder and the Emerald Drive will not count Auxiliary Encoder pulses until the first marker pulse is observed. This bit will always be read as a "0".

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 1		Phases 2, 3 and 4	Phases 2, 3 and 4	0

34810: CONFIGURATION OF HOME SWITCH

Assigns a control signal to the home switch by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in IDN 400.
Valid IDN's are (IDN 00401, 00402, 33500, 33501).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	401

34811: CONFIGURATION OF HOME SWITCH BIT

Configures the bit position of the home switch within the IDN defined by IDN 34810.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 15		Phases 2, 3 and 4	Phases 2, 3 and 4	0

34812: BOOT ROM VERSION

This IDN returns the revision of the drive's boot ROM.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Text	Variable			Phases 2, 3 and 4	None	

6.2.3   IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34813: REGEN POWER

This IDN returns the average power being dissipated by the internal regen resistor.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	4 bytes		1 Watt	Phases 2, 3 and 4	None	

34820: PASSWORD

This IDN is used to enter a password to unlock some special features.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	None	Phases 2, 3 and 4	Phases 2, 3 and 4	0

34821: TEST MODE PROCEDURE COMMAND

This procedure command puts the drive in a special mode for factory test purposes. A valid Password (IDN 34820) must be entered before entering test mode. After running in test mode the drive's power must be cycled in order to return to normal operation.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

34822: POWER TRANSISTOR BITMAP

This IDN is used to set the state of each power transistor individually. The drive must be in test mode for this IDN to be active.

BIT NUMBER	Transistor
Bit 0	U HI
Bit 1	U LO
Bit 2	V HI
Bit 3	V LO
Bit 4	W HI
Bit 5	W LO
Bit 6	REGEN
Bit 7 - 15	Reserved

An error will be generated if the following conditions are met:

1) An attempt is made to both transistors in a pair.
2) An attempt is made to change the state of both transistors in a pair simultaneously. Both transistors in a pair must be turned off before one of them can change from off to on.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Unsigned Decimal	2 bytes	0 - 65535	None	Phases 2, 3 and 4	Phases 4	0

35000: RESOLVER CARD CONFIGURATION

This IDN is used to setup the resolver option card. This parameter is stored in non-volatile memory. If it is changed from the current stored setting you will need to cycle the drive's power.

BIT NUMBER	DESCRIPTION
Bit 0	Reference Frequency 0 - 2500Hz 1 - 5000Hz
Bit 1	Gain 0 - 0.5 1 - 1.0
Bit 2	Accuracy 0 - 12 bit 1 - 14 bit
Bit 3 - 15	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 7		Phases 2, 3 and 4	Phases 2, 3 and 4	0

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

35001: RESOLVER FEEDBACK VALUE

This IDN is used to read the position returned from the resolver option card.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes			Phases 2, 3 and 4	None	

35002: RESOLVER FEEDBACK POLARITY PARAMETER

This parameter is used to switch polarities of reported position data for specific applications. There is a positive position difference when the resolver shaft turns clockwise (when viewed from the output shaft) and no inversion is programmed.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Resolver feedback value 0 - Non-inverted 1 - Inverted
Bit 1-15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 1		Phases 2, 3 and 4	Phases 2, 3 and 4	0

35011: AUXILIARY FEEDBACK VALUE

This IDN is used to read the position returned from the Auxiliary Encoder.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Signed Decimal	4 bytes			Phases 2, 3 and 4	None	

6.2.3 IDN DESCRIPTION - STANDARD PARAMETERS (cont'd)

35012: AUXILIARY FEEDBACK POLARITY PARAMETER

This parameter is used to switch polarities of reported position data for specific applications. There is a positive position difference when the encoder shaft turns clockwise (when viewed from the output shaft) and no inversion is programmed.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Auxiliary encoder feedback value 0 - Non-inverted 1 - Inverted
Bit 1-15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	Binary	2 bytes	0 - 1		Phases 2, 3 and 4	Phases 2, 3 and 4	0

35020: POSITION FEEDBACK 1 CONFIGURATION

Not implemented at this time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4	0

35021: POSITION FEEDBACK 2 CONFIGURATION

This IDN configures which auxiliary feedback device points to position feedback 2 (IDN 00053)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS	DEFAULT
Operation Data	IDN	2 bytes	35001, 35011		Phases 2, 3 and 4	Phases 2, 3 and 4	35011

SECTION 7 - FAULT CODES / STATUS

7.1   STATUS

Error! No topic specified.

Figure 7.1- System Status (7 Segment Status Display)

7.2 FAULT CODES

FAULT CODE	DESCRIPTION	REMEDY
F01 Internal Power Module Error	Driver has detected the following: • Overcurrent • Overheat • Gate voltage drop	Check if the motor wire (A/B/C) is shorted or grounded. Ambient temperature over 55° C. Indicates a fatal fault in the driver power stage. If motor wires are not shorted and temperature is below 55° C, contact IIS factory.
F02 Overvoltage	DC power bus exceeds max. bus voltage.	Power line voltage fluctuation above maximum. 264 VAC for ESD-XX/A style drives. Excessive regeneration energy. Check line voltage fluctuations. Add additional external regeneration resistor.
F03 Under Voltage	DC power bus below min. bus voltage.	Power line voltage fluctuation below minimum. 170 VAC or ESD-XX/A style drives. Check line voltage fluctuations. Check for missing phase of AC line power.
F04 DC Bus Contactor Error	DC bus contactor FAILED TO CLOSE CORRECTLY	Contact IIS factory
F07 Power Stage Error	Main control unit does not recognize the power stage of the driver.	Indicates a fatal fault in the driver power stage. Contact IIS factory.
F09 Regen Resistor Over Temperature	Excessive regen energy being dissipated by the internal or external regeneration resistor.	The frequency or rate of acceleration/deceleration may be too high. Excessive power line voltage. Add additional regen resistor capacity.
F10 Regen Resistor Open	Regen transistor is ON for more than 50ms.	**WITH POWER OFF:** If the drive has an internal regen resistor (20, 40, 60 Amp drives only), check that the resistance from P3 to R is: Approx. 100 ohms for 20 and 40 Amp Drives Approx. 50 ohms for 60 Amp Drive If an external regen resistor is used, verify the regen resistor is the proper value and that all wiring to the resistor is secure.
F15 Excessive Current	Motor current exceeds the rating by 120%.	Check if the motor wire (A/B/C) is shorted or grounded. Verify that motor shaft or machine system is not jammed. Check that the proper motor parameters have been sent to the drive.
F16 Speed amp Saturated	Internal speed loop is saturated and max.torque is applied for more than 3 sec.	Verify that motor shaft or machine system is not jammed. Check that the proper motor parameters have been sent to the drive. Acel/decel rate is too large for the inertia load on the motor causing maximum torque during acel/decel.
F19 Resolver Error	Resolver feedback error.	Check resolver cable and connectors. Verify that resolver cable is separated from power wiring to prevent noise coupling to resolver signals.

Table 7.1 - Fault Codes

7.2   FAULT CODES (cont'd)

FAULT CODE	DESCRIPTION	REMEDY
F25 Option	Self-diagnostic checks of options failed or wrong option card installed.	Option card configured in program does not match installed option card. Option card not functioning to specification. Return to factory.
F40 Encoder Signal Short	U, V or W phases of encoder not functional.	Check encoder cable and connections.

F50
Cycle Power
	A change has been made that requires the drive's control power to be cycled.	Power needs to be cycled to the drive if:
		    PWM switching frequency is changed
		    Option card configuration is changed
		
		Cycle the drive's control power.

F70 Following Error	Motor is not following the command	Check monitoring window (IDN 00159). Check for binding in mechanical travel of motor.
F71* SERCOS synchronization Error	The drive is not maintaining synchronization with the SERCOS master.	Contact IIS Factory.
F72 Non-Volatile Parameter Failure	Non-Volatile calibration data has been lost.	Contact IIS Factory.
F73 Amplifier Over-Temperature	Drive heat-sink temperature rose to over 105°C.	Ambient temperature exceeds 55°C. Continuous current demand from the drive exceeds its rating. Reduce the ambient temperature. Decrease current demand on the drive.
F74 Encoder Phase Error	Encoder A or B tracks are out of phase with U track.	Check encoder wiring. Make sure there are no loose connections. Make sure encoder cable is separated from any high-power wiring.
F75 W-Phase Over-Current	W-phase current exceeds the rating by 120%.	Check if the motor wire (A/B/C) is shorted or grounded. Verify that motor shaft or machine system is not jammed. Check that the proper motor parameters have been sent to the drive.
F80* SERCOS MST Error	Drive has detected unacceptable errors in the Master Sync Telegrams of the SERCOS Communication	Check fiber optic connections on the SERCOS Ring. Replace fiber optic cable.
F81* SERCOS MDT Error	Drive has detected unacceptable errors in the Master Data telegram	Check fiber optic connections on the SERCOS Ring. Replace fiber optic cable.
F82* Invalid SERCOS Phase	Drive has detected an invalid phase in the initialization of the SERCOS Ring	Contact IIS Factory.
F83* SERCOS Phase UP_SHIFT Error	Invalid sequence of the SERCOS Ring Initialization Phases	Re-initialize the SERCOS Ring at the controller.

Table 7.1 - Fault Codes (cont'd)

7.2   FAULT CODES (cont'd)

FAULT CODE	DESCRIPTION	REMEDY
F84* SERCOS Phase DOWN_SHIFT Error	Invalid sequence of the SERCOS Ring Initialization Phases	Re-initialize the SERCOS Ring at the controller.
F85* SERCOS Phase Switching Error	Attempt to switch phase with out satisfying the requirements of the previous phase.	Verify that all required parameters are written in Phase 2 (See IDN 00018) and that Command 127 and 128 execute successfully.
F86 Invalid Operation Mode	A request was made to switch to an invalid operation mode.	Check for a programming error.
F90 I/O Device 1 Communication Error	The drive cannot communicate with I/O device 1.	Check that there is power to the I/O CAN network. Check that the address switches are set properly for I/O device 1. Check the I/O CAN network cabling.
F91 I/O Device 2 Communication Error	The drive cannot communicate with I/O device 2.	Check that there is power to the I/O CAN network. Check that the address switches are set properly for I/O device 2. Check the I/O CAN network cabling.
F94 I/O Device 1 Wrong Type	Configured I/O Device 1 type and actual device type do not match.	Check that your program has the correct I/O Device type configured for device 1.
F95 I/O Device 2 Wrong Type	Configured I/O Device 2 type and actual device type do not match.	Check that your program has the correct I/O Device type configured for device 2.
F98 No I/O CAN Network Power	External I/O CAN network power is off.	Make sure you have an external power supply for the I/O CAN network. Check the cabling between the I/O devices and the drive.

Table 7.1 - Fault Codes (cont'd)

* Indicates a fault that can only exist when the drive is configured for SERCOS communications.

Fault Code	Class 1 Diagnostics (IDN 00011)																Manufacturer Class 1 Diagnostics (IDN 00129)															
	Bit 0: reserved	Bit 1: Amplifier overtemperature error	Bit 2: reserved	Bit 3: reserved	Bit 4: reserved	Bit 5: Feedback error	Bit 6: Error in the "commutation" system	Bit 7: Over current error	Bit 8: Over voltage error	Bit 9: Under voltage error	Bit 10: reserved	Bit 11: Excessive position deviation	Bit 12: Communication Error	Bit 13: reserved	Bit 14: reserved	Bit 15: Manufacturer-specific error	Bit 0: Sercos synchronization error	Bit 1: Non-volatile parameter loss	Bit 2: I/O CAN network error	Bit 3: Regen resistor error	Bit 4: Power board not recognized	Bit 5: Power module error	Bit 6: Cycle of power required	Bit 7: Option card error	Bit 8: reserved	Bit 9: reserved	Bit 10: reserved	Bit 11: reserved	Bit 12: reserved	Bit 13: reserved	Bit 14: reserved	Bit 15: reserved
F01																X						X										
F02								X																								
F03									X																							
F07																X					X											
F09																X				X												
F10																X				X												
F15								X																								
F16								X																								
F19							X																									
F25																X							X									
F40							X																									
F50																X						X										
F70													X																			
F71																X	X															
F72																X		X														
F73		X																														
F74							X																									
F75								X																								
F80													X																			
F81													X																			
F82													X																			
F83													X																			
F84													X																			
F85													X																			
F86													X																			
F90																X				X												
F91																X				X												
F94																X				X												
F95																X				X												
F98																X				X												

Table 7.2 - Cross Reference of Fault Codes to Class 1 Diagnostics

7.3   I/O CAN NETWORK STATUS DISPLAY

STAT

The bi-color (green/red) LED provides the I/O CAN network status. It indicates whether or not the devices have power and are operating properly. The table below defines the status LED states.

STATE	LED IS	TO INDICATE
No Power	Flashing Red	There is no power applied to the device. See also fault code F98
Network Operational	Green	The entire network is operating in a normal condition.
Device Error	Red	At least one of the I/O devices is missing or not operational. See also fault codes F90, F91, F94, and F95.
Watchdog Error	Flashing Green/Red	Indicates that the microprocessor watchdog timer has timed out. This display is not necessarily related to the I/O CAN network. Contact IIS factory.

7.4   SERCOS RECEIVER ERROR LED

When this LED is on, the driver is indicating that it is receiving bit errors or transmission errors from the device preceding it in the SERCOS Ring. To trouble shoot, first verify that the SERCOS master is trying to communicate to the driver. If the SERCOS Master SERCOS communication is not active then the Error LED is appropriate. If communications is established or is trying to be established then further checks are necessary. Verify all devices in the ring are connected correctly (**Section 5.5**). Verify that the SERCOS communication baud-rate on all devices in the ring is set the same. Verify all devices have unique device ID (**Section 6.1**). Verify transmitter power of the device preceding the Emerald in the ring is set correctly for the length of fiber optic cable connected between the devices. Replace if necessary any suspected damaged fiber optic cables. (NOTE: Only active in SERCOS mode.)

APPENDIX B - ESD-IO16 I/O EXPANDER

B.1   OVERVIEW

This manual is organized so that information is easy to find and easy to use. It begins by giving a general description of the ESD I/O-16. Next, a comprehensive hardware specification is provided followed by connector wiring diagrams, and finally the status indicators.

B.2   DESCRIPTION

The ESD I/O-16 provides I/O for Industrial Indexing Systems E-Series and is a DIN rail mounted assembly. Power supplied to the ESD I/O-16 is 24V DC. See section 3 on specifications. Each ESD I/O-16 may be configured to have 16 I/O in any configuration. Each E-Series Device can support 2 ESD I/O-16. The ESD I/O-16 must be configured through the EDE (Emerald Development Environment) to function as needed.

The ESD I/O-16 is connected to an E Series Device using an IIS EXC-XYZYYY cable (see **Appendix A**). Two ESD I/O-16 can be connected together using 2 EXC-XYZYYY cables **(**see **Appendix A).**

The ESD I/O-16 reads SW1 to determines the address. If the address is valid it starts trying to establish a connection with the ESD-Drive. When the E-Series device receives the request for a connection from the ESD I/O-16 it responds by sending over the I/O configuration. After the ESD I/O-16 receives the configuration the status returned to the E-Series device is changed indicating that the ESD I/O-16 is correctly configured. The E-Series device then begins requesting data and setting the output state every 1 millisecond. If the something causes the update rate to be greater then 1 millisecond then the ESD I/O-16 will return to the not configured state. The E-Series device will fault when this happens.

B.3   SPECIFICATIONS

B.3.1   POWER REQUIREMENT

Control Voltage	24V DC +/- 10% .25 Amps

B.3.2   ENVIRONMENT

Storage Temperature	-10 to 70°C/14-158°F
Operating Temperature	0 to 55°C/32-131°F
Humidity	35 to 90% Relative Humidity, non-condensing
Shock and Vibration	1 G or less
Operating Conditions	Free of dust, liquids, metallic particles and corrosive gases. Use in a pollution degree 2 environment.

B.3.3 SIZE

Length	11.54 in.
Width	3.00 in.
Height	4.00in. ref. Depending on I/O height.

Error! No topic specified.

Figure B.1 - ESD Layout

B.3.4 DIGITAL INPUTS/OUTPUTS

PART NUMBER	DESCRIPTION
GIAC5	90 to 140 VAC Input Module
GIAC5A	180 to 280 VAC Input Module
GIDC5	10 to 32 VDC/15 to 32 VAC Input Module
GIDC5LOW	3 to 32 VDC Input Module
GOAC5A	24 to 280 VAC Output Module
GODC5	5 to 60 VDC Output Module

NOTE: Be sure to check the current requirements, timing, size, and voltage levels when selecting modules. The modules must be 5 Volt Logic.

B.4 WIRING

B.4.1 POWER & COMMUNICATION WIRING

See **Appendix B** for details.

CONNECTOR P1 PIN #	COMMUNICATION FUNCTION	POWER FUNCTION
1	V-	24V GND
2	CAN_L	Termination Resistor
3	DRAIN/SHIELD	Earth Ground
4	CAN_H	Termination Resistor
5	V+	24VDC

B.4.2 I/0 WIRING

I/O is wired to the ESD I/O-16 using TB1 as shown in **Figure B.2**. **Figure B.3** shows how the different modules should be wired.

Error! No topic specified.
Figure B.2 - ESD Wiring Using TB1

B.4.2 I/O WIRING (cont'd)

Error! No topic specified.

Figure B.3 - Wiring for Modules

B.5 HARDWARE CONFIGURATION, DIP SWITCH SETTING

SW1 is located between P1 and P2. The 4 switches in the DIP determine the address of the ESD I/O-16. The table below lists the settings and the resulting DINT addresses. All other settings will cause the ESD I/O-16 to not function.

SW1				Address
1	2	3	4	
ON	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	2

B.6 STATUS LEDS

The Tables below list all the Staus LEDs on the board and their purpose.

LED	COLOR	DESCRIPTION	
1	Green	ESD Status	Flashing - WatchDog failure Solid on - Power on
2	Red	Can Status	Flashing - Invalid address Solid on - Invalid Configuration
3	Green	Comm Status	Flashing -Trying to connect to drive. Solid On - Communicating with drive

APPENDIX C - EMC INSTALLATION GUIDELINES FOR EMERALD SERIES MOTORS AND DRIVERS

C.1 INTRODUCTION TO EMC GUIDELINES

This chapter provides guidance and requirements when installing IIS Emerald Series motors and drivers into industrial control machinery required to be CE marked. These guidelines are intended to provide the machine builder with the necessary EMC information, including parts and wiring techniques to comply with the European Community Standards for industrial control equipment. The final conformance to the standards for the overall machine remains the sole responsibility of the machine builder.

C.2 EMC REQUIREMENTS

In 1996, the European Community enacted standards concerning conducted and radiated emissions and immunity to various types of interference for industrial control equipment. The EMC Directive 89/336/EEC and harmonized standards define specific EMC levels and test procedures to gain conformance.

Emission Standards provide maximum levels of noise permitted to be generated by the equipment. Immunity Standards subject the equipment to various types of disturbances and verifies that the equipment continues to perform in a safe manner.

The IIS Emerald Series motors and drivers have been tested and have been shown to comply with the following standards when installed per the guidelines in this section.

EMISSIONS STANDARDS:

EN55011 Class A	Power line conducted noise
EN55011 Class A	Radiated noise

IMMUNITY STANDARDS:

EN61000-4-2	Static discharge
ENV50140 & ENV50204	Electromagnetic irradiation
EN61000-4-4	Burst noise injected into power and signal wiring
EN61000-4-5	Lightning surge into power line
ENV50141	RF frequency injection into power and signal wiring
EN61000-4-8	Power frequency magnetic field
EN61000-4-11	Power line fluctuation and drop out

C.3 CONTROL ENCLOSURE

The Emerald Series drivers must be installed in a suitable control enclosure that provides a good quality ground system and tight construction. The cabinets can be of welded construction, metal to metal conductive joints or have overlapping EMC gasketed joints. All joints and removable panels must have metal-to-metal ground contact. All hinged panels or doors must have a bonded ground wire from the hinged panel to the main body of the enclosure.

C.4 ENCLOSURE MOUNTING PANEL

It is highly recommended that a galvanized panel be used. Galvanized panels provide a continuous conductive surface that provides a low impedance ground plane for mounting the servo components.

The mounting panel must be grounded to the control enclosure with metal to metal joints, bolted together with external tooth lock washers or have multiple short ground jumper wires between the panel and the enclosure.

Painted panels can be used if the mounting area for the servo components and all grounding points have been masked off or have the paint removed.

All servo components that require grounding must use fasteners with external tooth lock washers.

C.5   POWER WIRING SHIELDING AND FILTERING

Proper shielding and filtering methods must be followed to prevent high frequency noise from exiting the control panel via the wiring to the driver. This section illustrates the recommended guidelines for the Emerald Driver.

Error! No topic specified.

Figure C.1 - Power Wiring Shielding and Filtering

C.5.1 POWER LINE FILTER

A filter must be installed between the Emerald Series Driver and the incoming power line to prevent conducted noise for getting onto the power line. It is recommended that a separate filter be used for each driver but it is possible to use a single larger filter to supply multiple drivers if the wiring between the filter and drivers is kept as short as possible. See **Figure C.1**.

The following power line filters are recommended for use with the Emerald Series motors and drivers:

Total Motor Capacity	Phase	SCHAFFNER ELECTRONIC AG
500W max.	1	FN 2070-3
500W -> 1000W	1	FN 2070-6
1000W ->2200W	3	FN 258-16
2200W -> 3700W	3	FN 258-30
3700W -> 6500W	3	FN 258-42
6500W -> 11000W	3	FN 258-55

C.5.2 DRIVER OUTPUT (MOTOR ARMATURE) FILTER

The Emerald Series Driver uses pulse width modulation (PWM) control of the motor windings. The PWM switching of the motor output generates transient voltages that must be suppressed before exiting the control enclosure. A simple ferrite core can be used as shown in **Figure C.1**.

The following ferrite core filters are recommended for use with the Emerald Series motors and drivers:

Drive Size	Manufacturer	Part Number
ESD-5/AEP -> ESD-60/AEP	Fair-Rite	0431176451

C.5.3 SHIELDED MOTOR CABLE

The motor armature cable between the driver and motor must be shielded and grounded at both the driver and motor end. The motor armature cable length between the control enclosure and motor must be less than 50 meters or additional shield is necessary. The shielded motor armature cables specified in **Appendix B** wire are recommended. Either SKINTOP or saddle clamp method of grounding must be used as shown in **Figure C.1**.

C.5.4 REGENERATION RESISTOR WIRING SHIEILDING (OPTION)

If the regeneration resistor is located in the same enclosure as the driver, shielded wire is not necessary if the wiring is kept as short as possible. If the regeneration resistor is located in another enclosure, the regeneration resistor wire must be shielded and grounded in both enclosures. The SKINTOP ground fittings or saddle clamp method of grounding must be used as shown in **Figure C.2**.

Error! No topic specified.

Figure C.2 - Regeneration Resistor Wire Shielding

C.6   DIGITAL CONTROL SIGNALS

High speed, fast rise time signals used with the Emerald driver, such as encoder inputs or pulse outputs, radiate high frequency noise. This noise must be suppressed to prevent excessive EMC radiation.

If the positioning controller and Emerald driver are in the same control enclosure, the cable between the two must be shielded and grounded at both ends. If the positioning controller is located in a separate control enclosure, the cable between enclosures must be a braided shielded cable with both enclosure entries grounded with SKINTOP fittings or saddle clamps.

EI-1 CTL-1

XFU-1,2

FU-1
FU-2
CR-1
D-1
CR-2
D-2
CB-1
CB-2
CB-3

PS-2

PS-1

37.00

10
10
11
11
22
23
24
25
30
85
3L
48
49
50

DRV-3 SW1 ON / SW2 ON NEEDLE
DRV-2 SW2 ON Y AXIS
DRV-1 SW1 ON X AXIS

Emerson

21.00

DATE	SYM	REVISION RECORD	DR	CK	CK
11APR06	0	PER ECN 06-092	JC		
11NOV06	A	PER ECN 06-327	JC		

CHECKED BY | DATE
APPROVED BY | DATE
APPROVED BY | DATE
MATERIAL | -------------
FINISH | -------------

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE INCHES (mm)
TOLERANCES
X.X± = ---
X.XX± = ---
X.XXX± = ---
ANGULAR ± ---

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ENCLOSURE ASSEMBLY

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DATE 11APR06
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SHEET NO. 1 OF 1
REVISION A

B

CABINET MOUNTED
DISCONNECT
DISC-1

INCOMING LINE AC VOLTS
SEE NOTES 1 & 2

L1   1L1   FU-1   2L1   2L1   2L1
L2   1L2   FU-2   2L2   2L2   2L2
PE

TERMINALS FOR
CUSTOMER
SUPPLIED DEVICES

NOTES:
1) A LOCAL GROUND ROD IS RECOMMENDED FOR
GROUNDING THE ENCLOSURE.
2) POWER REQUIRED AT L1 & L2:
220 VAC NOMINAL ±10%
1Ø, 50/60 HZ, 30A SERVICE.

2L1   L
2L2   N
   GND
   COM
   COM
   +V
   +V

24VDC
POWER
SUPPLY
IPS-24/6.2
PS-1

2L1   L
2L2   N
   GND
   COM
   COM
   +V
   +V

12VDC
POWER
SUPPLY
IPS-12/2
PS-2

CR-2

3L1   3L2   10   11   20   21

TO: SHT 2   24 VDC   12 VDC
       TO: SHT 2   TO: SHT 4

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DIMENSIONS ARE INCHES (mm)
TOLERANCES
X.X ± --
X.XX ± --
X.XXX ± --
ANGULAR ± --

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21JUL06	A	PER ECN 06-174	CD		
07SEP06	B	PER ECN 06-251	CD		
11NOV06	C	PER ECN 06-327	JC		
13MAR07	D	PER ECN 07-053	CD		

FROM: SHT 1
24 VDC

3L1 3L2 10 11

DRV-1 X AXIS — ESD-5/AEP
CN5
MOTOR ENCODER
+ 10
+ 10
- 11
- 11
OK1
10 CR-2 12
D-2
OK2 13

CB-1
3L1 — 8L1 — L1
3L2 — 8L2 — L2
L3
P1
P2

EEC-AAA-MMM
A 6	GRN	(RED)	1
Ā 14	GRN/WHT	(BLK)	2
B 7	GRY	(WHT)	3
B̄ 15	GRY/WHT	(BLK)	4
Z 13	YEL	(GRN)	5
Z̄ 5	YEL/WHT	(BLK)	6
U 4	BRN	(BLU)	7
Ū 12	BRN/WHT	(BLK)	8
V 2	BLU	(BRN)	9
V̄ 10	BLU/WHT	(BLK)	10
W 3	ORN	(YEL)	11
W̄ 11	ORN/WHT	(BLK)	12
F5V 8	RED	(ORN)	13
E0V 9	BLK	(BLK)	14
SHLD 1		SHLD	15

ENCODER
MOT-1

EAC-AAZ-MMM
U	RED	(WHT/VIO)	A
V	WHT	(WHT/BRN)	B
W	BLK	(WHT/ORG)	C
	GRN	(GRN/YEL)	G
	BRN	(WHT/RED)	E
	YEL	(WHT/BLK)	F

CARRIAGE MOTOR

MOT-1 THERMAL CONTACT TO: SHT 3
3L1 / 4B

CASE GROUND

DRV-2 Y AXIS — ESD-5/AEP
CN5
MOTOR ENCODER
+ 10
+ 10
- 11
- 11
OK1 13
OK2 14

CB-2
3L1 — 10L1 — L1
3L2 — 10L2 — L2
L3
P1
P2

EEC-AAA-MMM (ENCODER) MOT-2

EAC-AAZ-MMM
FEED MOTOR
MOT-2 THERMAL CONTACT TO: SHT 3
48 / 49

CASE GROUND

DRV-3 NEEDLE — ESD-5/AEP
CN5
MOTOR ENCODER
+ 10
+ 10
- 11
- 11
OK1 14
OK2 11

CB-3
3L1 — 11L1 — L1
3L2 — 11L2 — L2
L3
P1
P2
P3
R-1 OPTIONAL — R

EEC-AAA-MMM (ENCODER) MOT-3

EAC-AAZ-MMM
NEEDLE MOTOR
MOT-3 THERMAL CONTACT TO: SHT 3
49 / 50

CASE GROUND
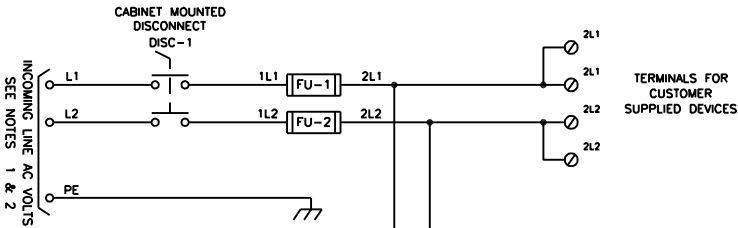
3L1 3L2 10 11
24 VDC
TO: SHT 3

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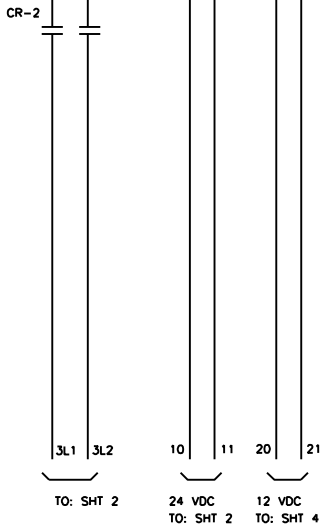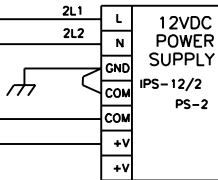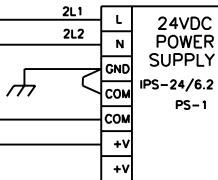FINISH

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X.XX ± ---	
X.XXX ± ---	

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11NOV06	C	PER ECN 06-327	JC		
13MAR07	D	PER ECN 07-053	CD		

FROM SHT 2
24 VDC

3L1 3L2   10 11

CONTROL POWER
PBL-1

PBL-1   85   25   W   11

OPTIONAL

EMERALD WATCHDOG   ESTOP   ESTOP   ESTOP   CR-2   CR-1   CR-1

	STANDARD I/O CONFIGURATION	OPTIONAL I/O CONFIGURATION
	ESTOP OK RELAY	ESTOP OK RELAY

10 ① ② 22 23   24   85   25   11

3L1 48 MOT-1 49 MOT-2 50 MOT-3 EI-1 IN1 3L2   MOTOR THERMAL   MOTOR THERMAL

Input	No.	Tag	Standard I/O	Optional I/O
PROX-1 N C	51	EI-1 IN2	X OVERTRAVEL RIGHT	Y LIMIT FRONT
PROX-2 N C	52	EI-1 IN3	Y OVERTRAVEL REAR	Y OVERTRAVEL REAR
PROX-3 N C	53	EI-1 IN4	HEAD DOWN	CUSHION CLAMP UP
PROX-4 N O	54	EI-1 IN5	HEAD UP	CUSHION CLAMP DOWN
PROX-5 N O	55	EI-1 IN6	LEFT FRAME LOCK	OUTER PLEAT
PROX-6 N O	56	EI-1 IN7	RIGHT FRAME LOCK	INNER PLEAT

EI-1 IN8   BLU / 3   OVERTRAVEL SENSOR   PNK / 2   11   Y OVERTRAVEL FRONT   PLEATER RETRACT
BRN / 1   BLK / 4   11

EI-1 IN9   WHT   PASSIVE THREAD SENSOR   BLK   11   THREAD BREAK   THREAD CUT OUT
RED   GRN

EI-1 IN10   NEEDLE UP SENSOR   11   NEEDLE UP   NEEDLE UP

Button	No.	Tag	Standard I/O	Optional I/O
STOP	57	EI-1 IN16	STOP PUSHBUTTON	SPARE
START	58	DRV-1 PROBE-2	START PUSHBUTTON	SPARE
RESTART	59	DRV-2 PROBE-1	RESTART PUSHBUTTON	SPARE
MOVE RETHREAD	60	DRV-2 PROBE-2	MOVE RETHREAD	SPARE
SEW HEAD ON	61	DRV-3 PROBE-3	SEW HEAD ON	SPARE

CR-1   DRV-3 PROBE-2   SPARE   SPARE
30

30   DRV-1 PROBE-1   ESTOP OK   ESTOP OK

Valve	No.	Tag	Standard I/O	Optional I/O
VALVE	83	EI-1 OUT11	NOT USED	MATERIAL CLAMP
VALVE	84	EI-1 OUT12	NOT USED	PLEAT EXTRACTOR
VALVE	85	EI-1 OUT13	NOT USED	PLEATS IN/OUT
VALVE	85	EI-1 OUT14	NOT USED	THREAD CUT
VALVE	85	EI-1 OUT15	NOT USED	NEEDLE COOLER

Output	No.	Valve	Standard I/O	Optional I/O
EI-1 OUT11	83	VALVE	FRAME LOCK	NOT USED
EI-1 OUT12	84	VALVE	FRAME UNLOCK	NOT USED
EI-1 OUT13	85	VALVE	THREAD CUT	NOT USED
EI-1 OUT14	85	VALVE	LIFT HEAD / OIL PUMP	NOT USED
EI-1 OUT15	85	VALVE	NEEDLE COOLER	NOT USED

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DIMENSIONS ARE INCHES (mm)
TOLERANCES
X.X±	----	ANGULAR
X.XX±	----	± ----
X.XXX±	----	

B

FROM: SHT 1
12 VDC
20   21

PS-1
FROM: SHT 2
24 VDC
FROM: SHT 3
10   22   10   11

EMC-2005
CTL-1

EP1 EJ1
WD 1 ① 10
WD 2 ② 22
+24VDC ③
24VCOM ④
GND   ⑤

CUSTOMER SUPPLIED

TOUCHSCREEN

COMPUTER

C-822000
C-987YYY

PORT 2

PORT 1

PORT 3
1
2
3
4
5

RECV
XMIT

ENCODER

PART OF
EI-1
ESD-I/O16
SW1
4
3
2
1
ON   ADDRESS 1

C-753YYY
3'

ADDRESS 1 ON

X AXIS
DRV-1

RECV

I/O BUS

XMIT

P2
11
1 GND
2
3 EARTH GND
4
5 +24V
10

EXC-AAAMMM

C-753YYY
1.5'

C-753YYY
3'

ADDRESS 2 ON

Y AXIS
DRV-2

RECV

I/O BUS

XMIT

C-753YYY
1.5'

ADDRESS 3 ON

NEEDLE
DRV-3

RECV

XMIT

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TOLERANCES
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DATE	SYM	REVISION RECORD	DR	CK	CK
11APR06	0	PER ECN 06-092	JC		
21JUL06	A	PER ECN 06-174	CD		
07SEP06	B	PER ECN 06-251	CD		
11NOV06	C	PER ECN 06-327	JC		
13MAR07	D	PER ECN 07-053	CD		