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PC840 Hardware & Software Reference Manual

Brushless Servo Drive with SERCOS Interface

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1 Overview of the PC840

Introduction This chapter introduces the PC840 SERCOS drive. Topics covered are:

- PC840 Overview
- PC840 Connection Diagram
- Setting Intensity and Baud Rate using SW4
- Setting up Serial Address Using Rotary Switches SW5 and SW6
- List of Supported IDNs

PC840 overview The PC840 SERCOS contains all the hardware and firmware necessary to connect to a SERCOS network.

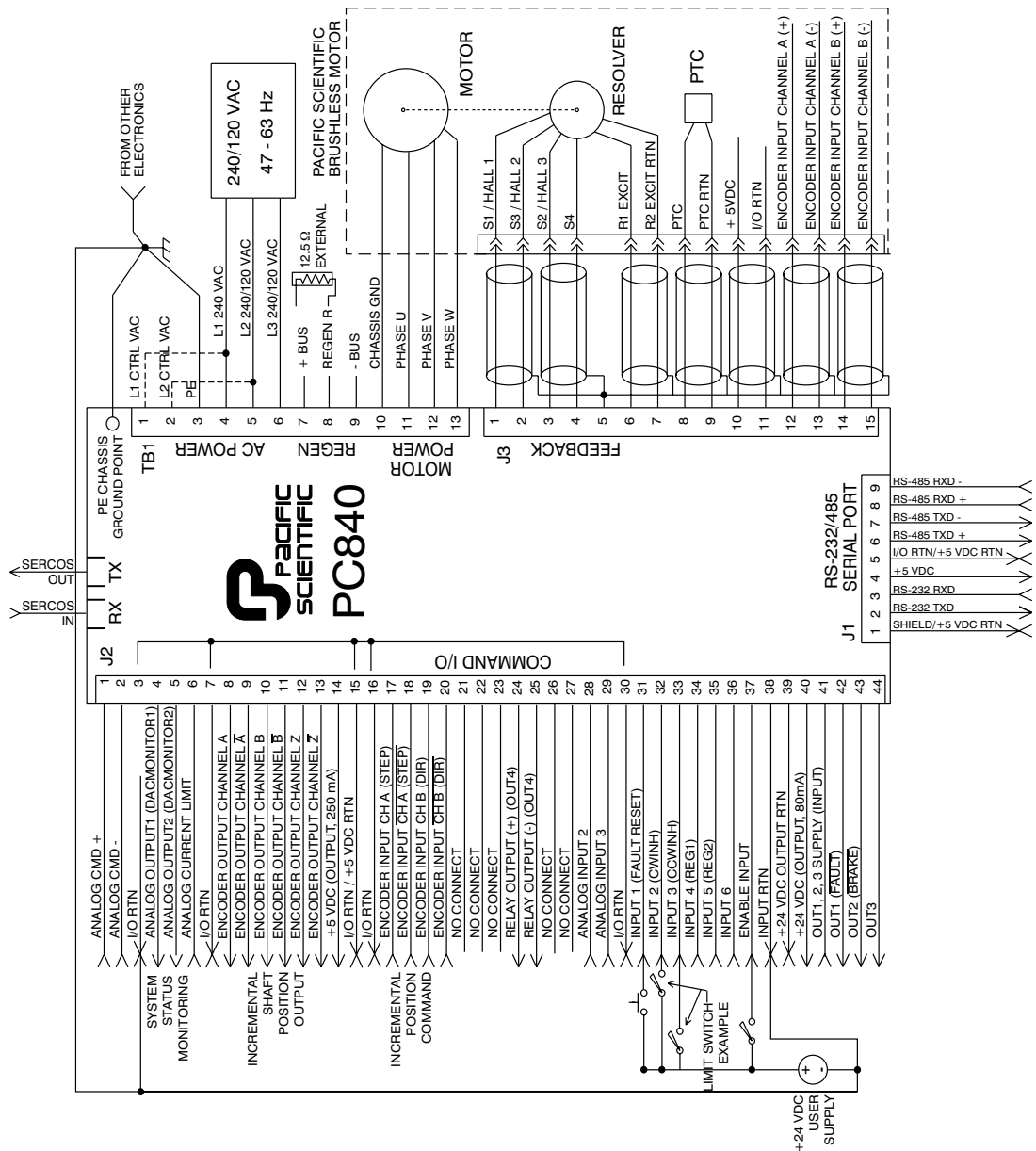
This chapter explains how to wire a PC840 system, defines switch settings, and lists the SERCOS IDNs the PC840 supports.

1.1 Interfaces and Connections

Introduction The diagrams on the following pages show the connections for inputs and outputs for the PC840.

- Power Board 13-Position Terminal Strip
- RS-232 Serial Port 9-pin female D-connector
- Command I/O 44-pin female D-connector
- Fiber Optic Transmit and Receive connectors

PC840 connection diagram

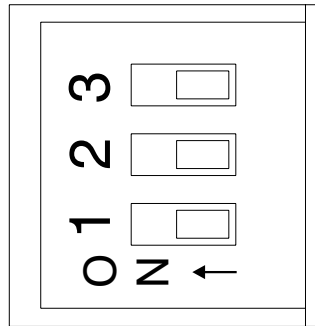


TO HOST SET UP OR CONTROL COMPUTER

1.2 Setting up Intensity and Baud Rate Using SW4

Definition Switch SW4 is used to select the SERCOS baud rate and the fiber optic light intensity (power level).

Switch SW4 The following diagram shows the location of switch S4.



Intensity Level

| SW4-1 | Fiber Optic Light Intensity Level |
|-------|-----------------------------------|
| ON | High power transmission |
| OFF | Low power transmission (default) |

Baud Rate

| Baud Rate | SW4-2 | SW4-3 |
|-------------------|-------|-------|
| 2 Mbaud (default) | OFF | OFF |
| 4 MBaud | OFF | ON |
| 8 MBaud | ON | OFF |
| 16 MBaud | ON | ON |

1.3 Setting up Serial Addresses Using Switches SW5 and SW6

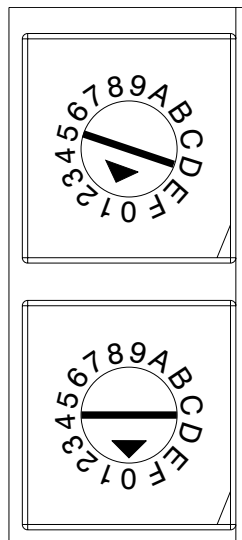
Definition The two hexadecimal rotary switches SW5 and SW6 are used to set the axis address for each PC840 on the SERCOS ring.

Procedure The following diagram shows the location of switch SW5 and SW6. The view shows the location of the switches looking at the front of the PC840.

Note: *Each PC840 must have a unique serial address.*

Switch SW5 and SW6 The diagram below shows the SW5 and SW6 switch settings.

The 8-bit address consists of two hexadecimal digits. The low and high digits are determined by the position of SW5 and SW6.



Note: *The axis address is set to 1 by default at the factory.*

Procedure

1. Remove power from the PC840 servocontroller.
2. Refer to the table below to set the PC840 to the appropriate address.

Address table

| Address | SW6 | SW5 | Address | SW6 | SW5 |
|---------|-----|-----|---------|-----|-----|
| 0* | 0 | 0 | 18 | 1 | 2 |
| 1 | 0 | 1 | 19 | 1 | 3 |
| 2 | 0 | 2 | 20 | 1 | 4 |
| 3 | 0 | 3 | 21 | 1 | 5 |
| 4 | 0 | 4 | 22 | 1 | 6 |
| 5 | 0 | 5 | 23 | 1 | 7 |
| 6 | 0 | 6 | 24 | 1 | 8 |
| 7 | 0 | 7 | 25 | 1 | 9 |
| 8 | 0 | 8 | 26 | 1 | A |
| 9 | 0 | 9 | 27 | 1 | B |
| 10 | 0 | A | 28 | 1 | C |
| 11 | 0 | B | 29 | 1 | D |
| 12 | 0 | C | 30 | 1 | E |
| 13 | 0 | D | 31 | 1 | F |
| 14 | 0 | E | 32 | 2 | 0 |
| 15 | 0 | F | ... | ... | ... |
| 16 | 1 | 0 | ... | ... | ... |
| 17 | 1 | 1 | 255** | F | F |

*Repeater Application Only

**Not Allowed for SERCOS Applications

3. Re-connect power to the PC840.
4. Repeat steps 1 through 4 for other units on the ring.
Make sure to give the other units unique addresses.

1.4 Identification Numbers (IDNs)

Introduction This is the list of SERCOS IDNs which are supported by the PC840. For additional information on each IDN please consult a SERCOS specification or Chapter 6.

- List of supported IDNs**
- 1 Control Unit Cycle Time (TN_{vc})
 - 2 Communication Cycle Time (T_{scvc})
 - 3 Shortest AT Transmission Starting Time (T_{1min})
 - 4 Transmit/Receive Transition Time (T_{ATMT})
 - 5 Minimum Feedback Processing Time (T_{4min})
 - 6 AT Transmission Starting Time (T₁)
 - 7 Feedback Acquisition Capture Point (T₄)
 - 8 Command Value Valid Time (T₃)
 - 9 Position of Data Record in MDT
 - 10 Length of Master Data Telegram
 - 11 Class 1 Diagnostic
 - 14 Interface Status
 - 15 Telegram Type Parameter
 - 16 Configuration List of AT
 - 17 IDN List of all Operation Data
 - 18 IDN List of Operation Data for CP2
 - 19 IDN List of Operation Data for CP3
 - 21 IDN List of Invalid Operation Data for CP2
 - 22 IDN List of Invalid Operation Data for CP3
 - 24 Configuration List of the MDT
 - 25 IDN List of all Procedure Commands
 - 28 MST Error Counter

| | | |
|----------------------|----|--|
| IDNs (Cont'd) | 29 | MDT Error Counter |
| | 30 | Manufacturer Version |
| | 32 | Primary Operation Mode |
| | 36 | Velocity Command Value |
| | 40 | Velocity Feedback Value |
| | 41 | Homing Velocity |
| | 42 | Homing Acceleration |
| | 43 | Velocity Polarity Parameter |
| | 44 | Velocity Data Scaling Type |
| | 45 | Velocity Data Scaling Factor |
| | 46 | Velocity Data Scaling Exponent |
| | 47 | Position Command Value |
| | 51 | Position Feedback Value 1 (Motor Feedback) |
| | 52 | Reference Distance 1 |
| | 55 | Position Polarity Parameter |
| | 76 | Position Data Scaling Type |
| | 77 | Linear Position Data Scaling Factor |
| | 78 | Linear Position Data Scaling Exponent |
| | 79 | Rotational Position Resolution |
| | 80 | Torque Command Value |
| | 82 | Positive Torque Limit Value |
| | 83 | Negative Torque Limit Value |
| | 84 | Torque Feedback Value |
| | 85 | Torque Polarity Parameter |
| | 88 | Receive to Receive Recovery Time (TMTSY) |
| | 89 | MDT Transmission Starting Time (T2) |

| | | |
|----------------------|-----|---|
| IDNs (Cont'd) | 90 | Command Value Proceeding Time (TMTSG) |
| | 95 | Diagnostic Message |
| | 96 | Slave Arrangement |
| | 99 | Reset Class 1 Diagnostic |
| | 100 | Velocity Loop Proportional Gain (kvp) |
| | 101 | Velocity Loop Integral Action Time (kvi) |
| | 103 | Modulo Value |
| | 104 | Position Loop Kv Factor (kpp) |
| | 106 | Current Loop Proportional Gain 1 (kip) |
| | 107 | Current Loop Integral Action Time 1 (kii) |
| | 110 | Amplifier Peak Current |
| | 127 | Communications Phase 3 Transition Check |
| | 128 | Communications Phase 4 Transition Check |
| | 129 | Manufacturer Class 1 Diagnostic |
| | 130 | Probe Value 1 Positive Edge |
| | 131 | Probe Value 1 Negative Edge |
| | 132 | Probe Value 2 Positive Edge |
| | 133 | Probe Value 2 Negative Edge |
| | 140 | Controller Type |
| | 142 | Application Type |
| | 143 | SYSTEM Interface Version |
| | 147 | Homing Parameter |
| | 148 | Drive-Controlled Homing Procedure Command |
| | 159 | Monitoring Window |
| | 160 | Acceleration Data Scaling Type |
| | 161 | Acceleration Data Scaling Factor |

| | | |
|----------------------|-----|---|
| IDNs (Cont'd) | 162 | Acceleration Data Scaling Exponent |
| | 169 | Probe Control Parameter |
| | 170 | Probing Cycle Procedure Command |
| | 185 | Length of the Configurable Data Record in the AT |
| | 186 | Length of the Configurable Data Record in the MDT |
| | 187 | IDN List of Configurable data in the AT |
| | 188 | IDN List of Configurable data in the MDT |
| | 189 | Following Distance (PosErrorMax) |
| | 192 | IDN List of Backup Operation Data |
| | 263 | Load Working Memory Procedure Command |
| | 264 | Backup Working Memory Procedure Command |
| | 301 | Allocation of Real-Time Control Bit 1 |
| | 303 | Allocation of Real-Time Control Bit 2 |
| | 305 | Allocation of Real-Time Status Bit 1 |
| | 307 | Allocation of Real-Time Status Bit 2 |
| | 400 | Home Switch |
| | 401 | Probe 1 |
| | 402 | Probe 2 |
| | 403 | Position Feedback Value Status |
| | 405 | Probe 1 Enable |
| | 406 | Probe 2 Enable |
| | 409 | Probe 1 Positive Latched |
| | 410 | Probe 1 Negative Latched |
| | 411 | Probe 2 Positive Latched |
| | 412 | Probe 2 Negative Latched |

| | |
|----------------------|---------------------------------|
| IDNs (Cont'd) | 32800 DSP Debug Address |
| | 32801 DSP Debug Word |
| | 32802 DSP Debug Dword |
| | 32803-32806 ARM Debug Variables |
| | 32807 Pole Count |
| | 32809 Filter Value for ADF0 |
| | 32810 DM1F0 |
| | 32811 DM2F0 |
| | 32812 DM1Gain |
| | 32813 DM2Gain |
| | 32814 DM1Map - Mux Select |
| | 32815 DM2Map - Mux Select |
| | 32816 EncOut (Encoder Output) |
| | 32817 InpMap1 |
| | 32818 InpMap2 |
| | 32819 InpMap3 |
| | 32820 InpMap4 |
| | 32821 InpMap5 |
| | 32822 InpMap6 |
| | 32823 EncInFilt |
| | 32824 RemoteFB |
| | 32826 CommOff |
| | 32828 EncIn (Encoder Input) |
| | 32829 ITThresh |
| | 32830 StopTime |
| | 32831 VBusThresh |

IDNs (cont'd)

32832 VelLmtHi
32833 VelLmtLo
32835 CoastTime
32836 CommEnbl
32837 Motor 1 Name
32838 Motor 2 Name
32840 Kvff
32841 ARZ0
32842 ARZ1
32843 ARF0
32844 ARF1
32845 Firmware version
32846 Encoder Data Scaling Method
32847 Encoder Modulo Value
32853 CommSrc (Commutation Source)
32857 ResPos (Resolver Position)
32858 Last Fault
32859 Last ExtFault
32860 OutMap1
32861 OutMap2
32862 OutMap3
32863 OutMap4
32866 Analog Input Voltage Offset (ADOffset)
32870 $I^2 \cdot t$ Motor Protection Threshold Value ($I^2 \cdot t_{Filt}$)
32871 $I^2 \cdot t$ Motor Protection Low Pass Filter Value ($I^2 \cdot t_{F0}$)
32872 $I^2 \cdot t$ Motor Current Value

| | |
|----------------------|---|
| IDNs (cont'd) | 32875 State of Hall Sensors (HallState) |
| | 32876 Offset Angle for Hall Sensors (HallOffset) |
| | 32878 Digital Command Counts (DigitalCmd) |
| | 32879 Digital Command Frequency (DigitalCmdFreq) |
| | 32880 AnalogOut1 |
| | 32881 AnalogOut2 |
| | 32882 Analog Current Limit Value (AnalogILmt) |
| | 32883 Analog Current Limit Gain (AnalogILmtGain) |
| | 32884 Analog Current Limit Filter (AnalogILmtFilt) |
| | 32885 Analog Current Limit Offset (AnalogILmtOffset) |
| | 32886 Actual Positive Current Limit (ActualILmtPlus) |
| | 32887 Actual Negative Current Limit (ActualILmtMinus) |
| | 34817 PC840 Input Bit #1 |
| | 34818 PC840 Input Bit #2 |
| | 34819 PC840 Input Bit #3 |
| | 34820 PC840 Input Bit #4 |
| | 34821 PC840 Input Bit #5 |
| | 34822 PC840 Input Bit #6 |
| | 34824 PC840 Input Port (Inputs) |
| | 34825 AnalogIn |
| | 34826 EncPos (Encoder Position) |
| | 34833 PC840 Output Bit #1 |
| | 34834 PC840 Output Bit #2 |
| | 34835 PC840 Output Bit #3 |
| | 34836 PC840 Output Bit #4 |
| | 34840 PC840 Output Port (Outputs) |

2 Interfaces and Connections

Introduction This chapter describes all of the connections to the PC840 and provides the information required to interface to it.

In the list below an overbar on a signal name means that the signal is active low logic. For example, “Fault” indicates the drive is faulted when it is pulled low.

Earth Ground Chassis Ground, M4 x 12 screw with flat and lock washer.

2.1 PC840 Power Board Connector

TB1 13 Position Terminal Strip

| Pin | Label | Description |
|--------|-------|---------------------------|
| TB1-1 | L1 | 240/120 VAC Control Power |
| TB1-2 | L2 | 240/120 VAC Control Power |
| TB1-3 | PE | Chassis Ground |
| TB1-4 | L1 | 240/120 VAC (Input) |
| TB1-5 | L2 | 240/120 VAC (Input) |
| TB1-6 | L3 | 240/120 VAC (Input) |
| TB1-7 | +B | + Bus |
| TB1-8 | R | Regen Transistor |
| TB1-9 | -B | - Bus |
| TB1-10 | PE | Chassis Ground |
| TB1-11 | U | Motor Phase U |
| TB1-12 | V | Motor Phase V |
| TB1-13 | W | Motor Phase W |

AC Power

L1, L2 (TB1-1, 2)
240 VAC
/ 120 VAC
Control Power

These terminals connect the 240/120 VAC power provided by the user to the drive's control voltage power supply.

If a single supply is used for bus power and control power, externally connect control L1, L2 (TB1-1, 2) to bus power L1, L2 (TB1-4, 5). **Control power L1, L2 are NOT connected internally to bus power L1, L2.**

Note: *The control voltage for the PC840 controllers is input to a switching power supply. This input will accept voltages ranging from 85 to 265 Vac.*

Chassis Ground

PE (TB1-3)

Convenience connector point for the user to connect the drive's control power and bus power to protective earth ground. This pin is directly connected to the chassis and thus to the Chassis Ground Stud. Local electrical code may require using the Earth Ground Chassis stud for this function.

AC Power

L1, L2, L3
(TB1-4, 5, 6)
240 VAC
/ 120 VAC

These terminals connect the 240/120 VAC power provided by the user to the drive's power output stage bus to drive the motor. For single phase operation use any two of these terminals and leave the third terminal open.

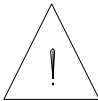
Regeneration Interface

+B, R, -B
(TB1-7, 8, 9)
+Bus, Regen
Resistor, - Bus

These terminals provide the connection points for an external resistor to absorb regenerated energy from the motor. An external regeneration resistor goes from + B to R. **-Bus (-B) on TB1-9 is usually left open.**

Caution! High Voltage!

During normal operation +B, R, and -B operate at the bus power voltages. A 240 Vac system operates at \cong 400 Vdc. These are dangerous voltages.



External Regen Resistor

The table below lists the recommended values for an external regen resistor. To order from Pacific Scientific use part number PRK-200.

Note: *Regen Resistance MUST be in the range of 11.25 Ω to 13.75 Ω .*

| Model | Resistance |
|-----------|--|
| PC8x2/3/4 | 12.5 Ω ($\pm 10\%$), 200 W, 1,500 V Isolation |

For safety it is recommended that the resistor be mounted on a grounded panel or use a grounding wire connected to a mounting screw. The terminals of the resistor must not be grounded.

Warning!

Wait 10 minutes after Bus Power is removed for the bus cap voltage to decay to a safe level before touching regen resistor or wiring. The voltage on the bus caps can be monitored with a voltmeter from +BUS (TB1-7) to -BUS (TB1-9).



Motor Power

PE (TB1-10)
Motor Case
Ground

This termination provides a convenient point for the motor ground connection and motor power wire shield. Local electrical code may require using the Earth Ground Chassis stud for this function.

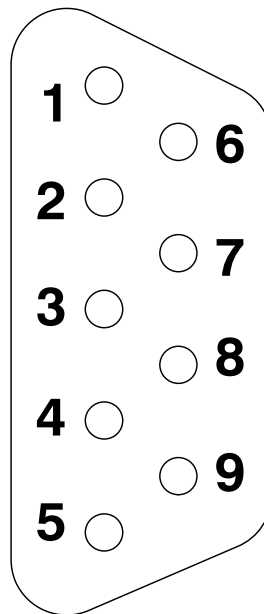
U, V, W
(TB1-11, 12, 13)
Motor Phase

These three terminations provide the 3-phase power output to the brushless motor. Observe motor polarity on these connections. For example, connect U on the drive to U on the motor.

2.2 Serial Port

J1 The serial port (J1), utilizes the 9 contact female D subminiature style connector shown below. A brief description of each signal is included in the J1 I/O table on following page. For additional information, please refer to the Serial Communications Transceiver Schematic at the end of this section.

J1 Diagram The figure below illustrates the pin-out for the 9 pin connector. It shows the front view looking at the PC840.



I/O Table

| Pin Number | Input/Output | Explanation |
|------------|--------------------|--|
| J1-1 | Shield | Common/shield - serial port interface |
| J1-2 | RS-232 TXD | RS-232 transmitter output (from PC840) |
| J1-3 | RS-232 RXD | RS-232 receiver input (to PC840) |
| J1-4 | Not Used | |
| J1-5 | I/O RTN/+5 VDC RTN | Common serial port interface |
| J1-6 | Not Used | |
| J1-7 | Not Used | |
| J1-8 | Not Used | |
| J1-9 | Not Used | |

The information provided in this section should be used to connect the PC840 to your computer for firmware upgrades.

2.2.1 RS-232 Connections

RS-232 Connections

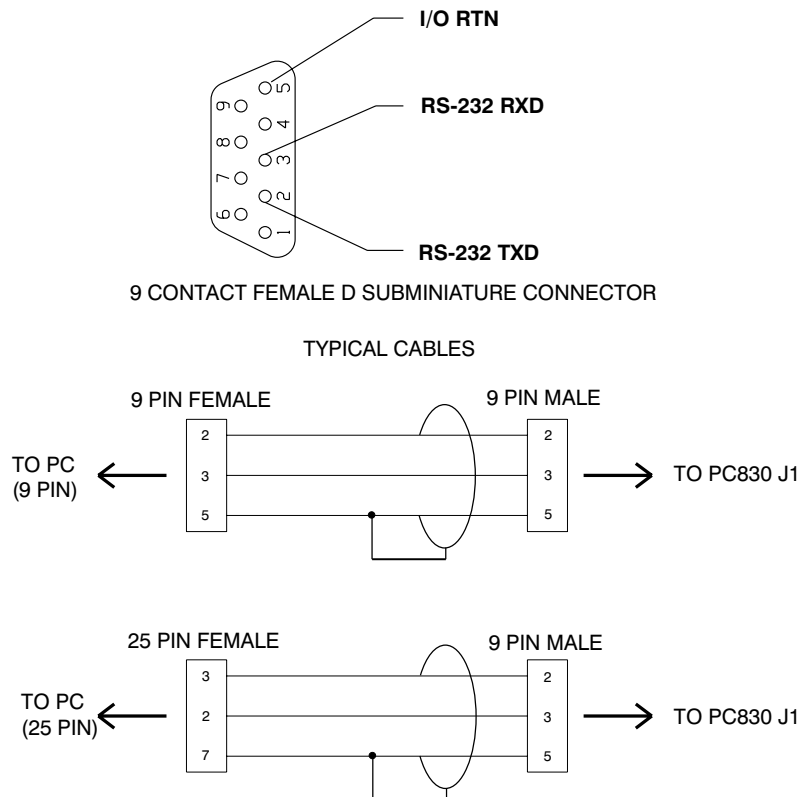
RS-232 connections on J1 are shown below. Cable wiring required for connecting to either 9 or 25 pin serial ports of most computers are also shown.

Note: Pinouts vary among computer manufacturers. Check the hardware reference manual for your machine before wiring.

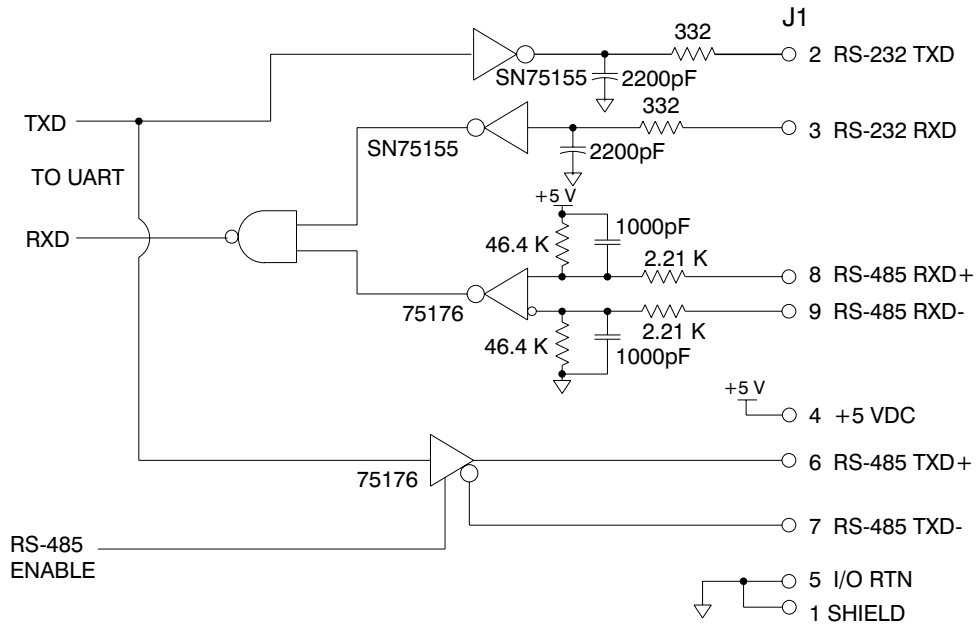
Cabling diagram

A 6 foot (1.8 m) RS-232 Cable with 9 pin connectors and a 9 pin to 25 pin adapter is available from Pacific Scientific. The Pacific Scientific order number is RS-232-5600.

Note: Shielded wiring is recommended for the serial communications cable to minimize potential errors from electrical noise.



PC840 Serial Communications Transceiver Schematic



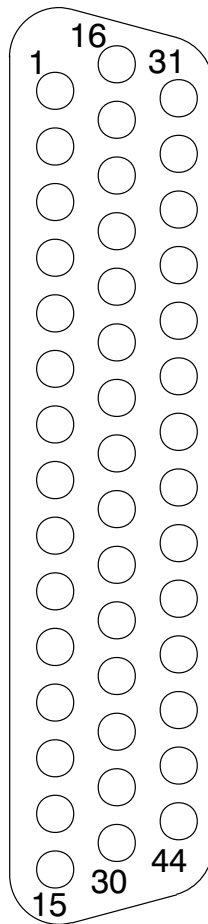
2.3 Command I/O

J2 44 Position D subminiature female

| Pin | Description | Pin | Description |
|-------|--|-------|-------------------------------|
| J2-1 | Analog Command Input (+) | J2-23 | No Connect |
| J2-2 | Analog Command Input (-) | J2-24 | Relay Output (+) (Out4) |
| J2-3 | I/O RTN | J2-25 | Relay Output (-) (Out4) |
| J2-4 | Analog Output1 (DacMonitor1) | J2-26 | No Connect |
| J2-5 | Analog Output2 (DacMonitor2) | J2-27 | No Connect |
| J2-6 | Analog Current Limit Input | J2-28 | Analog Input 2 |
| J2-7 | I/O RTN | J2-29 | Analog Input 3 |
| J2-8 | Encoder Output Channel A | J2-30 | I/O RTN |
| J2-9 | Encoder Output Channel \bar{A} | J2-31 | Input 1 (Fault Reset) |
| J2-10 | Encoder Output Channel B | J2-32 | Input 2 (CwInh) |
| J2-11 | Encoder Output Channel \bar{B} | J2-33 | Input 3 (CcwInh) |
| J2-12 | Encoder Output Channel Z | J2-34 | Input 4 (Reg1) |
| J2-13 | Encoder Output Channel \bar{Z} | J2-35 | Input 5 (Reg2) |
| J2-14 | +5 VDC (Output) | J2-36 | Input 6 |
| J2-15 | I/O RTN/ +5 VDC RTN | J2-37 | Enable Input |
| J2-16 | I/O RTN | J2-38 | Input RTN |
| J2-17 | Command Encoder Input Channel A (Step) | J2-39 | +24 VDC Output RTN |
| J2-18 | Command Encoder Input Channel A (Step) | J2-40 | +24 VDC (Output) |
| J2-19 | Command Encoder Input Channel B (Dir) | J2-41 | Out1, 2, 3 Supply (Input) |
| J2-20 | Command Encoder Input Channel B (Dir) | J2-42 | Out1 ($\bar{\text{Fault}}$) |
| J2-21 | No Connect | J2-43 | Out2 ($\bar{\text{Brake}}$) |
| J2-22 | No Connect | J2-44 | Out3 |

J2 Diagram

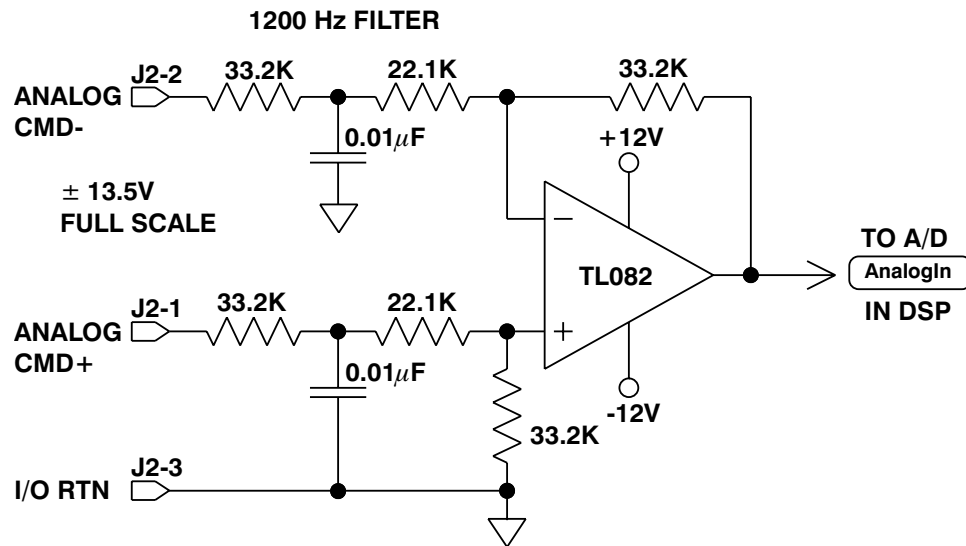
The figure below illustrates the pin-out for the 44 pin connector. It shows the front view looking at the PC840.



Command I/O

Analog CMD
(+), (-) Inputs
J2-1, 2

These inputs accept the analog command from the user. This is a differential input to an A/D. It has a maximum single ended input range with respect to I/O RTN on either input of $\pm 21\text{V}$ and an input impedance of $50\text{k}\Omega$. The full scale differential command input range is $\pm 13.5\text{V}$. The offset and single pole low pass bandwidth of this signal is adjustable via a software setup parameter. When used as a motion command the gain from this input is also adjustable via a software setup parameter.



Note: Always connect I/O RTN (J2-3) to the signal ground of the source. Failure to do so may result in erratic operation.

I/O RTN
J2-3, 7, 15, 16

This terminal is signal common for the analog and non-optically isolated digital inputs and outputs. These pins are internally connected in the drive.

For protection against line surges, one of the I/O RTN pins must be connected to Earth ground. Pacific Scientific recommends making this connection at an earth ground point in the cabinet reserved for single point grounding of all I/O Returns (drives and supplies).

Command I/O

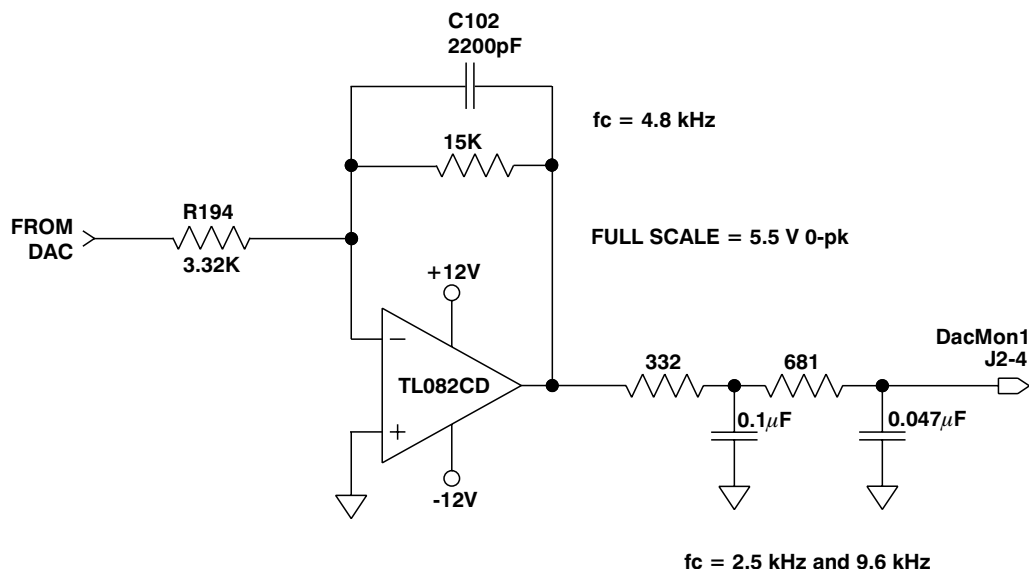
Continued

DAC Monitor 1, 2 Outputs J2-4, 5

These analog outputs are general purpose monitor points. The output range is ± 5.5 V with a resolution of $11\text{V}/65536 = 0.168$ mV. The source impedance is $1\text{ k}\Omega$, which yields a maximum short circuit to I/O RTN current of ± 5 mA. These outputs are updated every $250\ \mu\text{s}$. There is a 2.5 kHz , 4.8 kHz and a 9.6 kHz analog Low Pass Filter on these outputs.

Each DAC MONITOR can be mapped by software to be one of a number of internal variables. The scale factor and the frequency of a single low pass filter pole are software adjustable on each output by the DM1Gain, DM1F0 and DM2Gain, DM2F0 software parameters for DAC Monitor 1 and 2 respectively. Variables marked with a “*” are not range clamped and are allowed to wrap around when the signal exceeds the output dac’s voltage range. The other variables will clamp at maximum when they exceed the analog voltage range. The table on the following page lists the defined signal mappings.

DacMon



Dac Monitor List Table

| DMxMap | Variable | Description | DAC Out Units (DMxGain = 1) |
|--------|------------------|---------------------------------------|-------------------------------------|
| 0 | AnalogOutx | Actual Analog Output Command | V/V |
| 1 | VelFB | Measured Velocity (DM2 Default) | 1 V/kRPM |
| 2 | VelCmdA | Actual Velocity Command (VelCmdA) | 1 V/kRPM |
| 3 | VelErr | Velocity Error | 1 V/kRPM |
| 4 | FVelErr | Compensated Velocity Error | 1 V/kRPM |
| 5 | Position | Measured Position* | 1 V/Rev |
| 6 | PosError | Position Error* | 1 V/Rev |
| 7 | PosCommand | Commanded Position* | 1 V/Rev |
| 8 | Icmd | Commanded Torque Current | 1 V/A |
| 9 | IFB | Measured Torque Current (DM1 Default) | 1 V/A |
| 10 | AnalogIn | Filtered A/D Input | 1 V/V |
| 11 | EncFreq | Encoder Frequency | 1 V/Hz |
| 12 | EncPos | Encoder Position* | 10 V/4096 Cnts |
| 13 | ItFilt | Filtered Output Current Amplitude | 1 V/100% |
| 14 | HSTemp | Measured Heat Sink Temperature | 1 V/°C |
| 15 | | Commutation Electrical Angle* | 1 V/Cycle |
| 16 | IU | Motor Phase U Output Current | 1 V/A |
| 17 | IV | Motor Phase V Output Current | 1 V/A |
| 18 | IW | Motor Phase W Output Current | 1 V/A |
| 19 | | Motor Phase U Voltage Duty Cycle | 1 V/100% |
| 20 | | Motor Phase V Voltage Duty Cycle | 1 V/100% |
| 21 | | Motor Phase W Voltage Duty Cycle | 1 V/100% |
| 22 | VBus | Drive Bus Voltage | 1 V/V |
| 23 | ResPos | Resolver Absolute Position* | 1 V/Rev |
| 24 | | Commanded non-torque current | 1 V/A |
| 25 | | Measured non-torque current | 1 V/A |
| 26 | | Torque Voltage Duty Cycle | 1 V/100% |
| 27 | | Non-torque Voltage Duty Cycle | 1 V/100% |
| 28 | VelCmd | Velocity Command (VelCmd) | 1 V/kRPM |
| 29 | DigitalCmdFreq | Digital Command Frequency | 1 V/Hz |
| 30 | I ² t | I ² t Filtered Current | 1 V/%I _{peak} ² |

*These variables are allowed to wrap around when the signal exceeds the output voltage range.

J2 Command I/O Continued

Analog Current Limit J2-6 This input limits the current flow to the motor when a voltage is applied with respect to I/O RTN.

CH A OUT
CH A OUT,
CH B Out,
CH B Out
Outputs
J2-8, 9, 10, 11 These two output pairs are differential TTL incremental position signals generated by the Resolver feedback electronics. These outputs are quadrature encoded to emulate an optical encoder. The resolution of these signals, i.e. the emulated line count, is set by the EncOut parameter. These outputs are buffered by 26LS31 type RS-422 compatible line drivers. Maximum recommended load current is ± 20 mA, which corresponds to a minimum line-to-line load resistance of 100 Ω . This drive capacity corresponds to ten RS-422 compatible inputs such as the PC830 encoder inputs. These outputs are indefinitely short circuit proof to I/O RTN.

CH Z OUT
CH Z OUT
Outputs
J2-12, 13 These two terminals function as a differential, TTL marker pulse. The output pulse occurs once per motor shaft revolution starting at resolver position = 0 and its width is approximately one quadrature encoder width. This output comes from an 26LS31 type RS-422 compatible line driver. Maximum recommended load current is ± 20 mA, which corresponds to a minimum line-to-line load resistance of 100 Ω . This drive capacity corresponds to ten RS-422 compatible inputs such as the PC830 encoder inputs. This output is indefinitely short circuit proof to I/O RTN.

+5 VDC,
I/O RTN/+5 VDC
RTN Output
J2-14, J2-15 These two connections provide an auxiliary power supply for the user. This output is 5 Vdc $\pm 5\%$ and is short circuit protected at 1 A nominal. The maximum load limit for all connections to this supply is 250 mA. The +5 VDC RTN (J2-15) is connected to I/O RTN (J2-3, J2-7, J2-16, J2-30).

J2 Command I/O Continued

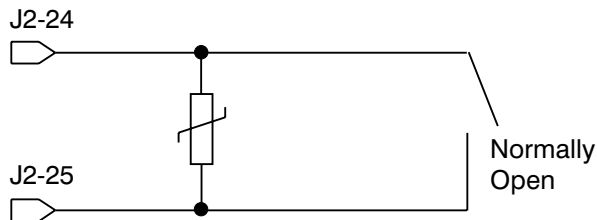
Encoder Inputs CH A IN, CH \bar{A} IN, CH B IN, CH \bar{B} IN,
Step +, Step -, Dir +, Dir -,
Step Up +, Step Up -, Step Dn +, Step Dn -

J2-17, 18, 19, 20 These inputs are used as a quadrature encoder, step and direction, or up and down count format incremental signal source. The decoding mode is set by the EncMode parameter. The scale factor of this incremental position command input is fully adjustable with software parameters. Full decoding speed or more noise immune slow speed decoding is software selectable.

These two input pairs are differential and are detected by 26LS32 type RS-422 compatible line receivers. As differential inputs, the recommended common mode range is $< \pm 7$ V with respect to I/O RTN and the guaranteed differential voltage logic thresholds are $> \pm 0.2$ V. Recommended drivers should be able to source and sink > 3 mA to/from these inputs. Each of these inputs have internal bias networks to allow easy connection to single ended sources. When an input is open circuited it will bias itself to between 2.2 and 2.5 V, thus the remaining input pair terminal will have a single ended guaranteed logic low for inputs < 2.0 V and a guaranteed logic high for inputs > 2.7 V. These levels are compatible with a TTL driver combined with a pull up resistor. Pull up resistor should be $< 470\Omega$.

J2 Command I/O Continued

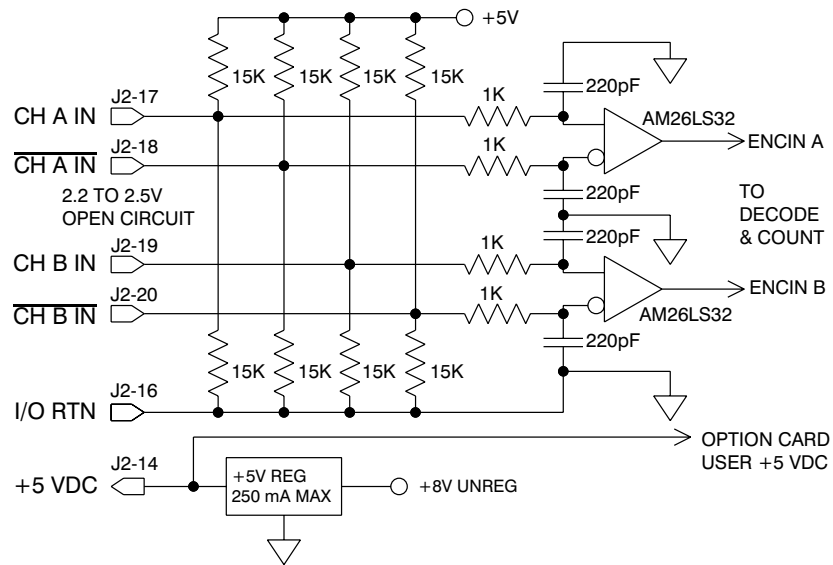
Relay Outputs J2-24, 25 These relay outputs are normally open. They are rated for 1 Amp at 30 VDC. These relays may be opened/closed by Out4. When the drive has no control power the relay is open.



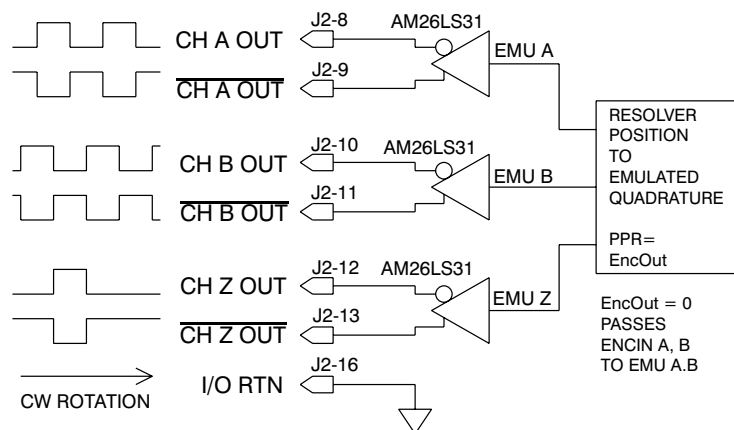
Brake Output This output is low when the control power is off, or when control voltage is on and the drive is disabled (Enabled = 0). This output is pulled high otherwise. This output is intended to drive a normally open relay that in turn powers a mechanical brake on the motor shaft for applications that require a positive shaft lock when the servo drive is off.

J2 Encoder I/O Interface Schematics Diagram

ENCODER INPUTS

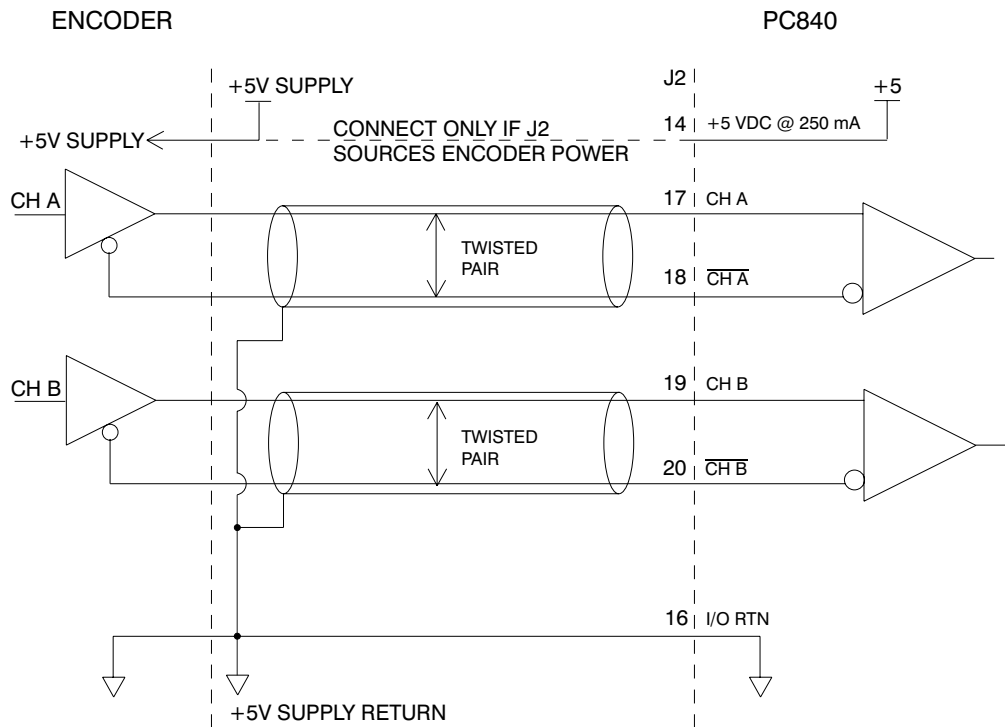


EMULATED ENCODER OUTPUTS

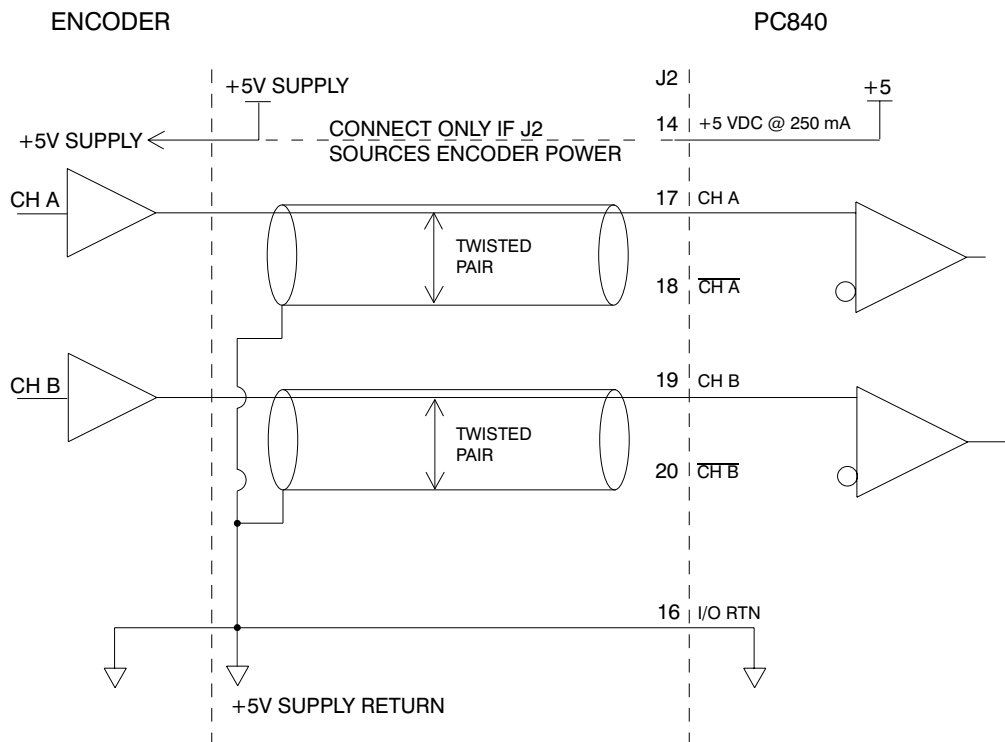


PC840 BASE UNIT ENCODER I/O

**Using TTL
differential line
drivers**



**Using TTL
single-ended
drivers**



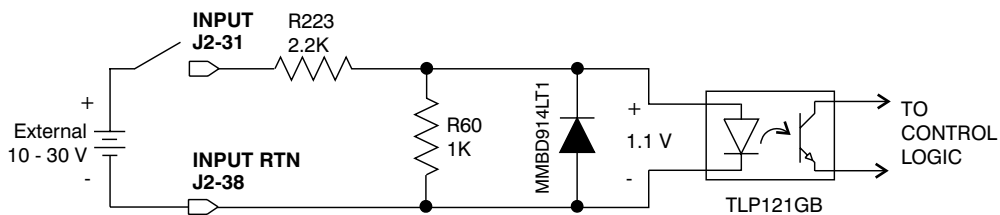
J2 Command I/O Continued

Auxiliary Analog Inputs J2-28, 29 Not Used.

Inputs 1-6 J2-31, 32, 33, 34, 35, 36 These six optically isolated I/O connections are user programmable discrete 24 V inputs. These inputs share a floating return (J2-38) with the Enable Input (J2-37). A minimum drive capability of 4 mA is required to fully power the opto. The user must supply 10 - 30 V to these inputs.

Note: 5 V inputs CAN NOT be used.

Each of the inputs is set and read by software every 2 mSec. Each one can be configured to be any of the available functions and the configuration can be changed on the fly via digital communications. The user's default configuration is stored in the non-volatile memory. The present state of each of these lines can be read via digital communications. The logic polarity of these signals is also software programmable. That is, an input can be defined to be active low or active high. For edge triggered functions the active edge is programmable.



| Logic State | InpX with respect to Input RTN |
|-------------|--------------------------------|
| Low | 0 to +2 V |
| Undefined | +2 V to + 10 V |
| High | +10 V to + 30 V |

J2 Command I/O Continued

The list below describes the subset of the available functions and the mappings used as the factory defaults for each of the inputs.

Fault Reset Input

Input 1: This input is used to reset the amplifier following a fault. This input is programmed active high so that an open circuited input does not activate the function. During Fault Reset active the output stage is disabled and the reset condition will be held in hardware for approximately 0.1 sec after Fault Reset is returned inactive.

CwInh Input

Input 2: This input prevents further motion in the clockwise shaft motion direction. This input is programmed active high so that an open circuited input does not activate the function. If the shaft is already moving in the clockwise direction, then the motor will decelerate to zero velocity with the maximum torque allowed by the user set output current limits. This input will have no effect on motion in the counterclockwise direction. This input is useful for a clockwise over travel limit switch.

CcwlNh Input

Input 3: Analogous to the CwInh input, except that this input prevents counterclockwise motion.

Reg1 Input

Input 4: This high speed input latches motor position within 50 μ sec after a transition.

Reg2 Input

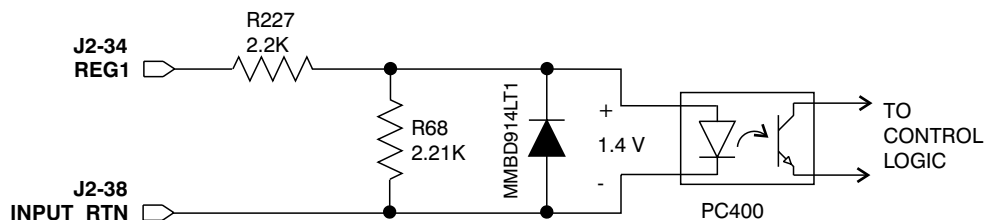
Input 5: Analogous to Reg1 input.

Input Mapped Off

Input 6: Input Mapped Off

Reg1 Input J2-34

Note: Probe inputs have a 50 μ sec latch time.

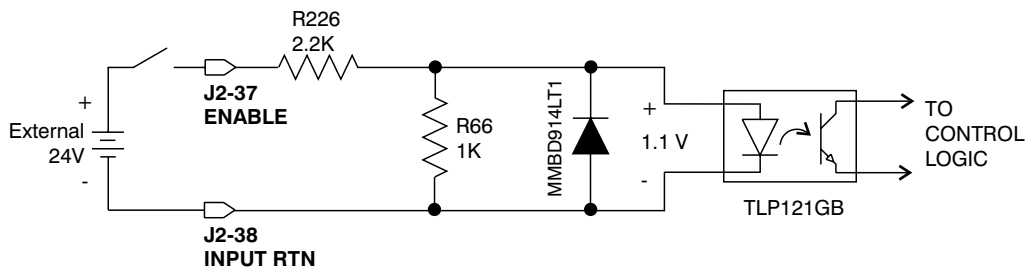


J2 Command I/O Continued

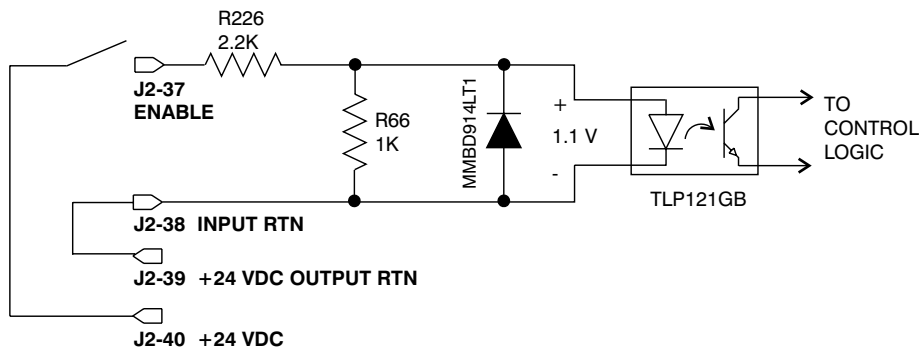
Enable Input J2-37

This optically isolated input is used to enable the drive and is active high. The output stage is disabled when this input is inactive. A minimum drive capability of 4 mA is required. The user must supply 10 V - 30 V to drive this input. This input is filtered with a 1 mSec time constant low pass filter to prevent false triggering from noise. The Enable input shares a floating return (J2-38) with Inputs 1 - 6.

Note: 5 V input *CAN NOT* be used.



Note: If the drive's 24 V supply is being used, connect as shown below.



J2 Command I/O Continued

Input RTN
J2-38 This terminal is the floating common return for the six optically isolated digital inputs and the optically isolated Enable input.

+24 VDC RTN,
+24 VDC (Output)
J2-39, J2-40 These two connections provide an auxiliary floating power supply for the user. This output is 24 Vdc \pm 10 % and is short circuit protected at 100 mA nominal. The maximum load limit for all connections to this supply is 80 mA. + 24 VDC RTN is not connected to Input RTN.

Out1, 2, 3
Supply (Input)
J2-41 The PC840 requires an external 12 - 24 VDC power source for the outputs. This power source must be capable of supplying at least 150 mA.

Outputs
J2-42, 43, 44 These optically isolated outputs are current sourcing at 0 to 50 mA maximum. External output supply should be limited to 30 V. These outputs are short circuit protected. Current folds back to about 25 mA during a short circuit. The external output supply (J2-41) is shared by the three outputs.

| | |
|---------------|---------------------------------|
| V_{ON} | 1.9 V @ 25 mA 2.25 V @ 50 mA |
| I_{OFF} | 5 μ a |
| Response time | 1 msec |
| Clamp voltage | 40 V (nominal) |

Each of the outputs is set and written to by software every 2 mSec. Each one can be configured to be any of the available functions and the configuration can be changed on the fly via digital communications. The user's default configuration is stored in the non-volatile memory. The present state of commanded outputs can be read via digital communications. The logic polarity of these signals is also software programmable. That is, an output can be defined to be active low or active high. For edge triggered functions the active edge is programmable.

J2 Command I/O Continued

The list below describes the subset of the available functions and the mappings used as the factory defaults for each of the outputs.

$\overline{\text{Fault}}$ Output

Output 1: This output is low when the drive is faulted or has no control power. This line can be used to indicate a problem with the drive.

Output Mapped Off

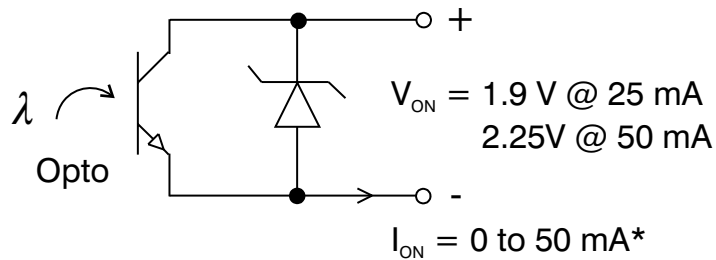
Output 2: Output Mapped Off

Output Mapped Off

Output 3: Output Mapped Off

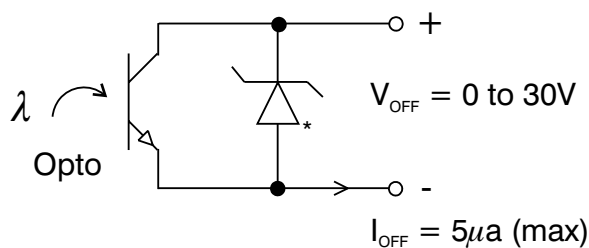
Outputs

ON State



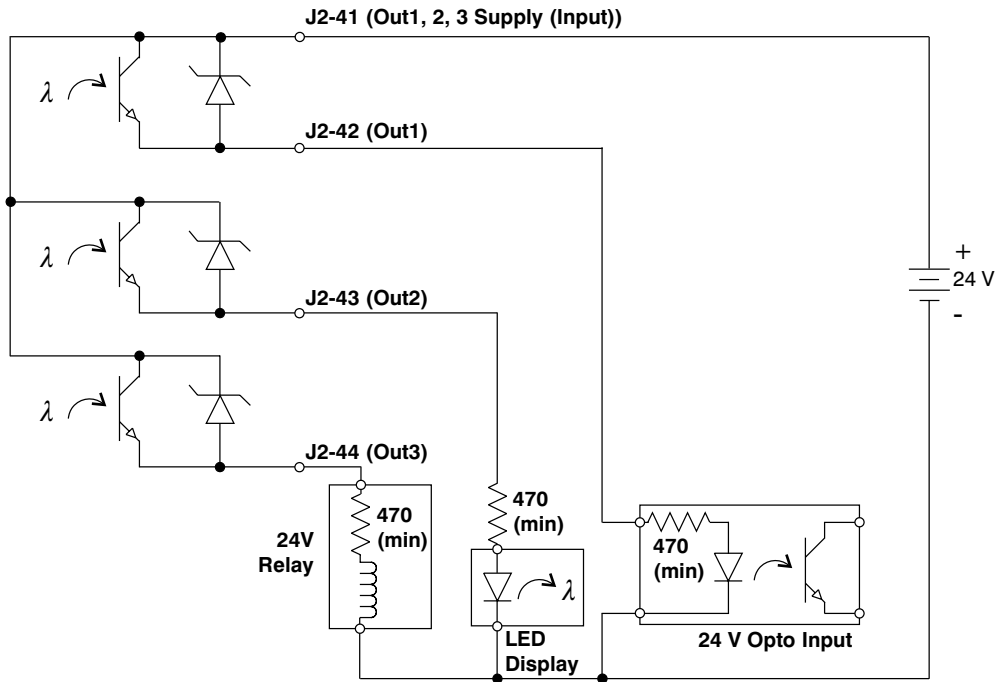
*During short circuit folds back to 25 mA

OFF State

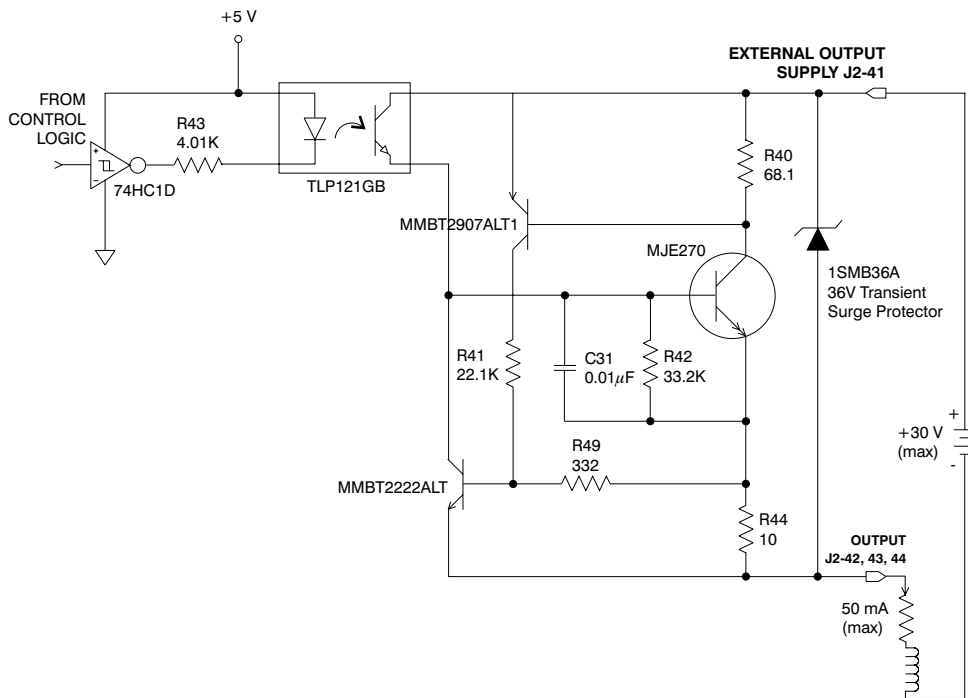


*36V Transient Surge Protector clamps @ 40 V nominal

Outputs Driving Typical Loads



Output Schematic



2.4 Feedback

J3

FEEDBACK 15 Position D subminiature female

| Pin | Description |
|------------|-------------------------------------|
| 1 | RESOLVER S1 SIN + (Input) / Hall 1 |
| 2 | RESOLVER S3 SIN - (Input) / Hall 2 |
| 3 | RESOLVER S2 COS + (Input) / Hall 3 |
| 4 | RESOLVER S4 COS - (Input) |
| 5 | SHIELD (I/O RTN) |
| 6 | RESOLVER R1 EXCITATION (Output) |
| 7 | RESOLVER R2 EXCITATION RTN (Output) |
| 8 | MOTOR PTC (Input) |
| 9 | MOTOR PTC RTN (Input) |
| 10 | +5 VDC |
| 11 | I/O RTN |
| 12 | FEEDBACK ENCODER CHANNEL A (+) |
| 13 | FEEDBACK ENCODER CHANNEL A (-) |
| 14 | FEEDBACK ENCODER CHANNEL B (+) |
| 15 | FEEDBACK ENCODER CHANNEL B (-) |

Feedback

Resolver S1, S2,
S3, S4 Inputs
J3-1, 2, 3, 4

These connections provide the inputs for the resolver's sine/cosine outputs. Differential inputs with 75 V μ sec common mode impulse range and 25 k Ω input impedance.

Note: *This only applies if a Resolver feedback device is being used.*

Hall1, Hall2,
Hall3
J3-1, 2, 3

These three single-ended hall channel sensor inputs are detected by +5 Vdc CMOS compatible commutation signals with 60° spacing. These inputs are each internally pulled-up to +5 Vdc via a 10 k Ω resistor. These input signals are low pass filtered in hardware at 10 kHz.

Note: *This only applies if a Hall feedback sensor is being used.*

Resolver R1
Excitation, R2
Excitation RTN
Outputs
J3-6, 7

These connections provide the resolver excitation output. 9.2 V rms at 6510.42 Hz 75 mA rms maximum load. These outputs are fully short circuit protected to I/O COMMON or to each other at room temperature (25°C), but at ambient temperatures above 50°C, shorts longer than 5 minutes may cause damage.

Motor PTC, PTC
RTN Inputs
J3-8, 9

These two inputs are intended to connect to a positive temperature coefficient thermistor or normally closed thermostatic switch imbedded in the motor windings. When the resistance between these terminals becomes greater than 6.2 k Ω the drive will fault and indicate a Motor Over Temperature fault. This circuit directly interfaces with Pacific Scientific's standard motor PTC.

Note: *PTC RTN is connected to I/O RTN.*

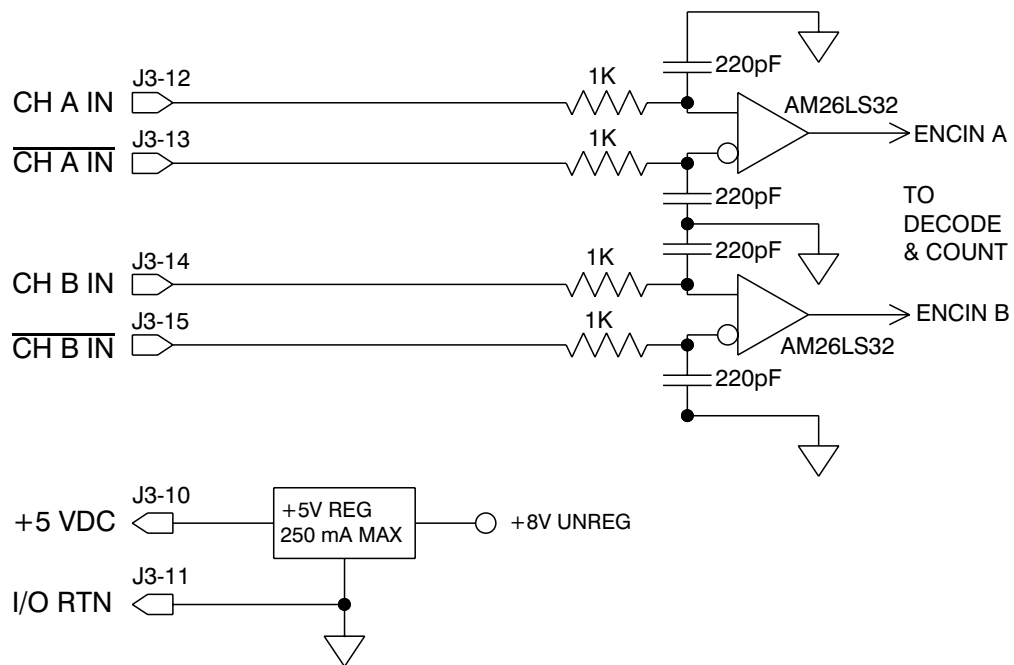
Feedback

Continued

Encoder Inputs
J3-12, 13, 14, 15

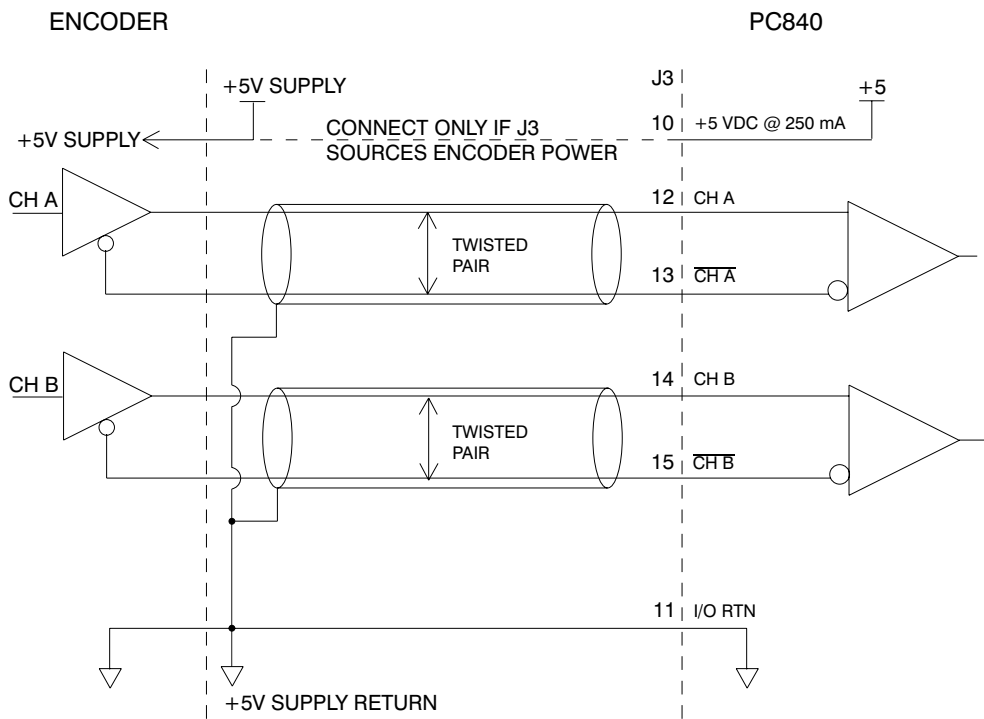
CH A, $\overline{\text{CH A}}$, CH B, $\overline{\text{CH B}}$,

These differential inputs expect quadrature encoder feedback signals. These two input pairs are differential and are detected by 26LS32 type RS-422 compatible line receivers. As differential inputs, the recommended common mode range is 7 V with respect to I/O RTN and the guaranteed differential voltage logic thresholds are ± 0.2 V. Recommended drivers should be able to source and sink > 3 mA to/from these inputs.

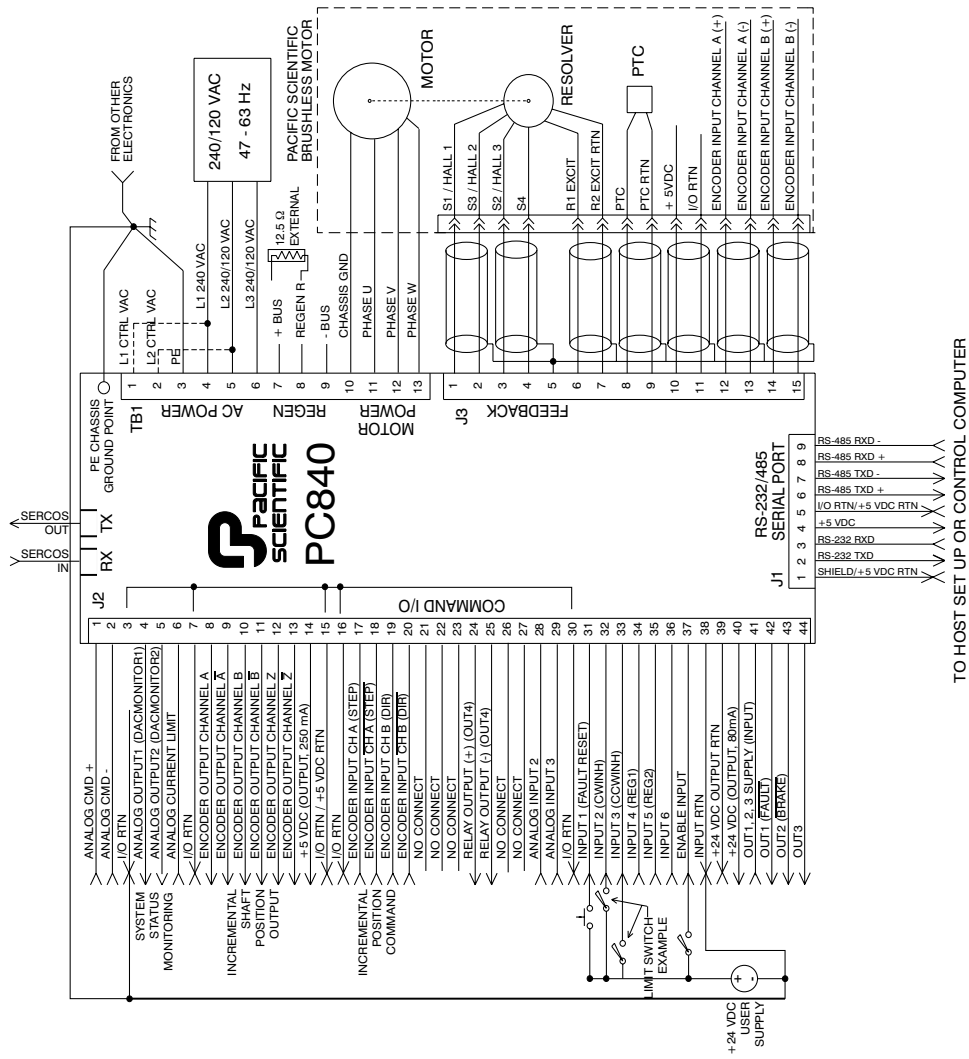


Note: An adapter can be powered from the serial port +5 Vdc output on J1-4 as long as the load current on J1-4, J2-14, and J3-10 total less than 250 mA.

Using TTL differential line drivers



Drive Wiring Diagram



3 Inputs/Outputs

Introduction

The PC840 has six digital user mappable inputs (J2-31 to J2-36), three digital user mappable outputs (J2-42 to J2-44), and one mappable relay output (J2-24, 25) which are available for users to interface to external devices; proximity switch, PLC, LED.

In addition, the PC840 has one analog input (J2-1, 2) and two analog outputs (J2-4, 5) that can be set to various output functions.

3.1 General Purpose Inputs/Outputs

The PC840 Input and Output pins are optically isolated from the rest of the PC840 and each other.

Below is a table of the applicable IDNs for the PC840 General Purpose I/O:

| IDN(s) | Description | Function |
|-------------|-------------------------|-------------------------------|
| 34817-34822 | PC840 Input Bits (1-6) | Read Input Bit (1-6) |
| 34824 | PC840 Input Port | Read Entire Input Port |
| 34833-34836 | PC840 Output Bits (1-4) | Read/Write Output Bits (1-4) |
| 34840 | PC840 Output Port | Read/Write Entire Output Port |

Service Channel

All of the above IDNs can be read through the SERCOS Service Channel. Reading an input bit would return the value of the bit located in the input port. Reading IDN 34824 would return the value of all the input bits as a single word. Reading an output bit would return the value the PC840 is attempting to drive on the output pin. Reading IDN 34840 would return the value the PC840 is attempting to drive on all the output pins.

Example

The PC840 has 00010101 on its input pins.
The PC840 is attempting to drive 00001010 on its output pins.
Reading IDN 34824 would return 0x15.
Reading IDN 34817 would return 1 (bit zero - input byte).
Reading IDN 34818 would return 0 (bit one - input byte).
Reading IDN 34821 would return 1 (bit four - input byte).
Reading IDN 34840 would return 0x0A
Reading IDN 34833 would return 0 (bit zero - output byte).
Reading IDN 34834 would return 1 (bit one - output byte).
Reading IDN 34836 would return 0 (bit four - output byte).

Cyclic Channel

The only two PC840 I/O IDNs which can be placed in the cyclic channel are IDN 34824 (Input Port) and IDN 34840 (Output Port). IDN 34824 (Input Port) can be placed in the AT and returns 2 bytes of data. The AT data would have the input port in the low byte of the return AT data and a zero in the high byte. IDN 34840 (Output Port) can be placed in the MDT and allows the user to write to the output pins once every MST cycle. The low byte of the written data would be placed into the output port, the high byte is ignored.

Real Time Control/Status

All of the input bit IDNs (34817 - 34822) and output bit IDNs (34833 - 34836) can be used through the use of real time control/status bits.

Use Control Bit IDNs (301 or 303) to update up to two output points within the cyclic channel update time. Writing an output bit IDN into either of the two allocation of control bit IDNs will cause the value of the real time control bit in the MDT to be placed into that output bit. Example, write one of the output bit IDNs (34833 - 34836) into IDN 301 or IDN 303. Then use the output bit IDN (Ex. 34833) to set the state of the output point. It will be updated within the cyclic channel update time.

Use Status Bit IDNs (305 or 307) to update up to two input points within the cyclic channel update time. Writing an input bit IDN into either of the two allocation of status bit IDNs will cause the value of the input bit to appear in the real time status bit returned in the AT. Example, write one of the input bit IDNs (34817 - 34822) into IDN 305 or IDN 307. Then use the input bit IDN (Ex. 34817) to read the state of the input point. It will be updated within the cyclic channel update time.

Example

Writing 34817 (PC840 Input Bit #1) to IDN 305 (Allocation of Real Time Status Bit 1) will cause the value of Input Bit #1 to appear as Status Bit 1 in the cyclic AT status word.

Writing 34822 (PC840 Input Bit #6) to IDN 307 (Allocation of Real Time Status Bit 2) will cause the value of Input Bit #6 to appear as Status Bit 2 in the cyclic AT status word.

Writing 34834 (PC840 Output Bit #2) to IDN 303 (Allocation of Real Time Control Bit 2) will cause the value of Control Bit 2 in the cyclic MDT to be written to Output Bit #2.

Writing 34836 (PC840 Output Bit #4) to IDN 301 (Allocation of Real Time Control Bit 1) will cause the value of Control Bit 1 in the cyclic MDT to be written to Output Bit #4.

**Inputs Table
(InpMapX)**

The following table lists the mappable input functions available for the Digital Inputs.

| Mappable Input Function | Function Number | Description |
|------------------------------------|------------------------|---|
| Analog Input Null | 7 | Nulls the analog input by setting ADOffset to old ADOffset minus AnalogIn |
| Counterclockwise Inhibit (default) | 6 | Inhibits motor motion in the counter-clockwise direction when asserted |
| Clockwise Inhibit (default) | 5 | Inhibits motor motion in the clockwise direction when asserted |
| Command Gain Select | 9 | Switches the analog input scale factor between CmdGain and CmdGain2 |
| Enable 2 | 3 | Second enable function |
| Fault Reset (default) | 1 | Resets drive faults |
| Home Switch Input | 15 | Home switch input for a homing move |
| No Function | 0 | Turns off mappable input functionality |
| Position Mode Select | 8 | Switches the active mode of operation to position mode |
| Run Stop | 2 | Selects between normal operation and setting the velocity command to zero |
| Velocity Command Source | 4 | Selects between VelCmd and VelCmd2 |

**Outputs Table
(OutMapX)**

The following table lists the mappable output functions available for the Digital and Relay Outputs.

| Mappable Output Function | Function Number | Description |
|---------------------------------|------------------------|--|
| Brake (default) | 3 | Indicates when the motor is not powered and a mechanical brake is needed to hold the motor |
| Electrical Revs | 5 | Square wave whose frequency is equal to the motor electrical frequency |
| Enabled | 2 | Indicates whether power can flow to the motor |
| Excess Position Error | 7 | Asserted when there is excess following error for an extended period of time (following error limit is defined by PosErrorMax) |
| Fault (default) | 1 | Indicates whether the drive has faulted and is disabled |
| Mechanical Revs | 4 | Square wave whose frequency is equal to the resolver's electrical frequency which is typically equal to the mechanical Rev/sec |
| No Function | 0 | Turns off mappable output functionality |
| Zero Speed | 6 | Activated when the motor's speed goes below the speed threshold set by the parameter ZeroSpeedThresh |

Active hi/lo

Each of the digital inputs and outputs can be defined as either active high or active low. If the mappable output function (bit) is configured as active HIGH (LOW) then when the function (bit) is asserted, the output will be HIGH (LOW).

**IDNs
32817 - 32822**

InpMapX IDNs set the logical functions of the inputs on J2-31 to J2-36. Bits must be set to determine the polarity and the function. The default settings for InpMap1 (IDN 32817) - InpMap6 (IDN 32822) are shown in the following table:

| InpMapX | Default State | Default Polarity | Default Value |
|------------------------|----------------------|-------------------------|----------------------|
| InpMap1 (IDN 32817) | General Purpose I/O | Active Low | 0x0 |
| InpMap2 (IDN 32818) | General Purpose I/O | Active Low | 0x0 |
| InpMap3 (IDN 32819) | General Purpose I/O | Active Low | 0x0 |
| InpMap4 (IDN 32820) | General Purpose I/O | Active Low | 0x0 |
| InpMap5 (IDN 32821) | General Purpose I/O | Active Low | 0x0 |
| InpMap6 (IDN 32822) | General Purpose I/O | Active Low | 0x0 |

**IDNs 32860 -
32863**

OutMapX IDNs set the logical functions of the outputs on J2-41 to J2-43. Bits must be set to determine the polarity and the function. The default settings for OutMap1 (IDN 32860) - OutMap4 (IDN 32863) are shown in the following table:

| OutMapX | Default State | Default Polarity | Default Value |
|---------------------|----------------------|-------------------------|----------------------|
| OutMap1 (IDN 32860) | General Purpose I/O | Active Low | 0x0 |
| OutMap2 (IDN 32861) | General Purpose I/O | Active Low | 0x0 |
| OutMap3 (IDN 32862) | General Purpose I/O | Active Low | 0x0 |
| OutMap4 (IDN 32863) | General Purpose I/O | Active Low | 0x0 |

Bit settings

To change the default settings follow the bit settings listed below.

Note: For general purpose I/O, the function number must be set to zero, with bit 15 also set to zero.

| Bit # | Description |
|-------|--|
| 15 | Polarity 0 = Active Low 1 = Active High |
| 4-14 | Must be 0 |
| 0-3 | Determine the function of the input or output. Refer to the Input and Output function tables. |

Reading/writing I/O

In order to set a pin as a general purpose input the InpMap IDN must be set to zero. Reading a Input pin would return the value of the input pin. Reading IDN 34824 would return the value of all the input pins as a single word.

Reading an Output pin would return the appropriate bit value located in the Output port. Reading IDN 34840 would return the value of the Output port.

Writing a 0 or 1 to IDNs 34833-34836 (Output Pins) will set Output Pins to that value, or writing a value between 0 and 15 to IDN 34863 (Output Port) will set the Output port to that value.

Example

To change the mapping of InpMap1 from General Purpose Input (default) to the Home Switch, perform the following:

1. Write 0xC0000008 to InpMap1 (IDN 32817).
2. Read the first bit of the Input Port (IDN 34824) or read Input 1 (IDN 34817) to monitor the state of the input.

Note: *IDN 34817 can only be read using the service channel. IDN 34824 can be read using the service channel or the cyclic channel.*

3.2 Probe/Registration Functionality

Introduction

In a typical application, probes are used to define the position of a part or the depth of a hole or cut. When the probe touches the surface, the switch closes and the position data is latched.

Position registration uses the closure of a proximity switch, photo eye, or similar device to signal the latching of position data.

On the PC840, during probing and registration, position latching is performed by the drive.

Guidelines

The PROBE 1 function must reside on Inp4 (J2-34) when probe/registration is in use.

The PROBE 2 function must reside on Inp5 (J2-35) when probe/registration is in use.

The two probe functions work identically, but require additional setup prior to use when compared to other Input functions.

Note: *When RemoteFB = 1 or 2 (IDN 32824), Probe 2 cannot be used to latch position. Probe 2 is used only as the marker pulse input for homing. Probe 1 can be used to latch position (encoder position). When RemoteFB = 0, Probe 1 and Probe 2 can be used to latch position (resolver position).*

Probe table

Below is a list of IDNs related to the Probe functionality:

| IDN | Description | Function |
|------------|--------------------------|---|
| 130 | Probe 1 Positive Edge | Returns Probe 1 Positive Edge Data |
| 131 | Probe 1 Negative Edge | Returns Probe 1 Negative Edge Data |
| 132 | Probe 2 Positive Edge | Returns Probe 2 Positive Edge Data |
| 133 | Probe 2 Negative Edge | Returns Probe 2 Negative Edge Data |
| 169 | Probe Control | Specifies which probe edges are active |
| 170 | Probe Cycle Command | Allows the beginning of a probe cycle |
| 401 | Probe 1 | Returns the current state of Probe 1 pin. |
| 402 | Probe 2 | Returns the current state of Probe 2 pin. |
| 405 | Probe 1 Enable | Enables the latching of data upon a Probe 1 edge. |
| 406 | Probe 2 Enable | Enables the latching of data upon a Probe 2 edge. |
| 409 | Probe 1 Positive Latched | Returns a '1' when Probe 1 Positive Edge data has been latched. |
| 410 | Probe 1 Negative Latched | Returns a '1' when Probe 1 Negative Edge data has been latched. |
| 411 | Probe 2 Positive Latched | Returns a '1' when Probe 2 Positive Edge data has been latched. |
| 412 | Probe 2 Negative Latched | Returns a '1' when Probe 2 Negative Edge data has been latched. |

Service channel operation

All of the above IDNs can be accessed through the Service Channel. For the probe function to take place, several of the IDNs must be set up prior to an event.

IDN 169**Probe Control Parameter:**

| Bit Number | Setting |
|---------------------------|--|
| 0 - Probe 1 Positive Edge | 0 = Positive edge inactive 1 = Positive edge active |
| 1 - Probe 1 Negative Edge | 0 = Negative edge inactive 1 = Negative edge active |
| 2 - Probe 2 Positive Edge | 0 = Positive edge inactive 1 = Positive edge active |
| 3 - Probe 2 Negative Edge | 0 = Negative edge inactive 1 = Negative edge active |

IDN 170

Probing Cyclic Procedure Command: A probing cycle procedure must be active in order for a probe event to be captured. This is done by writing a 3 to IDN 170. To cancel probing control write a 0 to IDN 170.

IDN 405

Probe 1 Enable: Probe 1 must be enabled in order to capture a probe 1 event.

| Bit Number | Bit Setting |
|------------|--|
| 0 | 0 = Probe 1 Not Enabled 1 = Probe 1 Enabled |

IDN 406

Probe 2 Enable: Probe 2 must be enabled in order to capture a probe 2 event.

| Bit Number | Bit Setting |
|------------|--|
| 0 | 0 = Probe 2 Not Enabled 1 = Probe 2 Enabled |

Note: *The above three items MUST be done to capture a probe event. They may be done in ANY order.*

Once the above items have been set, and the correct edge has occurred on the probe line, probe data will be latched.

Once the probe data are latched and ready to be sent to the Master, the correct Probe Latched bit (IDNs 409 - 412) will return a 1 when read.

- The latched position data can be read through IDNs 130 - 133.
- The initial default data is 0. Data are updated only after a probe event has occurred.
- The probe event can be reset by clearing any of the four control IDNs (IDNs 169, 170, 405/406) and then re-enabling them.

Example

Writing 1 to IDN 169 (Probe Control Parameter) will cause Probe 1 Positive Edge events to be recorded. IDNs 405 and 170 must still be configured.

Writing 1 to IDN 405 (Probe 1 Enable) will enable probe 1.

Writing 3 to IDN 170 (Probe Command) will initiate probing on probe 1 (INP4) and probe 2 (INP5). At this point, if probe 1 (INP4) did not transition (low to high), reading IDN 409 (Probe 1 Positive Latch) will return a 0 indicating a probe did not take place. Reading IDN 130 (Probe 1 Positive Edge Data) will return 0.

After a positive transition on probe 1 (INP4), reading IDN 409 (Probe 1 Positive Latch) will return a 1 indicating a probe had occurred. Reading IDN 130 (Probe 1 Positive Edge Data) will return the latched position. To latch position on probe 1 again, reset IDN 405 by writing a 0 and then a 1 to it.

Since probe 2 was not enabled using IDNs 169 and 406, reading probe 2 related IDNs will return 0.

Cyclic Channel

Of all the Probe Input IDNs, only IDNs 130 - 133 (IDNs which return latched position data) can be inserted into the AT. The data returned will either be 0 (no data has been latched) or the last latched data for that probe edge.

Real Time Control/Status Bits

All of the Probe Data Latched IDNs (IDNs 409 - 412) and Probe Enable IDNs (IDNs 405 and 406) can be used through the use of real time control/status bits. Writing the IDN of a Probe Data Latched into either of the two Allocation of Status Bit IDNs (IDN 305 or IDN 307) will cause the value of that IDN to appear in the real time status bit returned in the AT. Writing the IDN of the Enable Probe into either of the two Allocation of Control Bit IDNs (IDN 301 or IDN 303) will cause the value of the real time control bit in the MDT to be placed into that Probe Enable function.

Example

Writing 409 (Probe 1 Positive Data Latched) to IDN 305 (Allocation of Real Time Status Bit 1) will cause the value of Probe 1 Positive Data Latched to appear as Status Bit 1 in the cyclic AT status word.

Writing 412 (Probe 2 Negative Data Latched) to IDN 307 (Allocation of Real Time Status Bit 2) will cause the value of Probe 2 Negative Data Latched to appear as Status Bit 2 in the cyclic AT status word.

Writing 406 (Probe 2 enable) to IDN 303 (Allocation of Real Time Control Bit 2) will cause the value of Control Bit 2 in the cyclic MDT to be written to Probe 2 Enable.

Writing 405 (Probe 1 Enable) to IDN 301 (Allocation of Real Time Control Bit 1) will cause the value of Control Bit 1 in the cyclic MDT to be written to Probe 1 Enable.

Use of the Real Time Control/Status bit IDNs (IDNs 405, 406, 409 - 412) along with the cyclic channel IDNs (130 - 133) results in registration events recorded and acted upon in real time.

3.3 Analog Input

This IDN can be read through either the Service or the Cyclic channel.

IDN 34825 Allows the master to read the Analog Input on the base unit. The value of this IDN is:

$$\text{AnalogIn (V)} = \text{value read}/(954.3 * 2^{16})$$

IDN 32809 First-order low-pass filter corner frequency for the analog input channel on J2-1,2 (ADF0). This IDN should be set so that:

$$\text{IDN 32809 (ADF0)} = \text{Break Frequency of Analog Input Filter in Hz}$$

3.4 Analog Outputs

The analog outputs can be set to various output functions, including a user specified voltage.

The Analog Output function is selected using the DACMAP IDNs (IDNs 32814 and 32815). The DACMAP functions must be 'OFF' (IDNs 32814 or 32815 = zero) for user controlled AnalogOut. AnalogOut1 can be written to using IDN 34841. AnalogOut2 can be written to using IDN 34842. The break frequencies for the Analog Outputs' low-pass filter are IDNs DM1F0 (IDN 32810) and DM2F0 (IDN 32811).

IDN 32810 DM1F0 sets the frequency in Hz of a single pole low-pass filter on the DAC Monitor 1 output (J2-4). This IDN should be set so that:

$$\text{IDN 32810} = \text{Break Frequency (Hz)}$$

IDN 32811 DM2F0 sets the frequency in Hz of a single pole low-pass filter on the DAC Monitor 2 output (J2-5). This IDN should be set so that:

$$\text{IDN 32811} = \text{Break Frequency (Hz)}$$

Analog I/O IDNs Below is a list of the Analog Input and Output IDNs:

| IDN | Description | Function |
|-------|-------------|---|
| 32809 | ADF0 | Break Frequency for AnalogIn in Hz. |
| 34825 | AnalogIn | Analog Voltage Input |
| 32810 | DM1F0 | Break Frequency for AnalogOut 1 in Hz. |
| 32811 | DM2F0 | Break Frequency for AnalogOut 2 in Hz. |
| 32812 | DM1GAIN | Gain for AnalogOut1 - Scaling varies according to function |
| 32813 | DM2GAIN | Gain for AnalogOut2 - Scaling varies according to function. |
| 32814 | DM1MAP | Selects Variable to be mapped to AnalogOut1 |
| 32815 | DM2MAP | Selects Variable to be mapped to AnalogOut2. |
| 34841 | AnalogOut1 | Writes AnalogOut1 (If IDN 32814 = 0) |
| 34842 | AnalogOut2 | Writes AnalogOut2 (If IDN 32815 = 0) |

Example

User reads IDN 32809 (AnalogIn) to be 8000000.

Voltage on AnalogIn pin is:

$$8000000/(954.3*2^{16}) = 0.13 \text{ volts}$$

User reads IDN 32809 (AnalogIn) to be 200,000,000

Voltage on AnalogIn pin:

$$200,000,000/(954.3*2^{16}) = 3.2 \text{ volts}$$

Note: *The analog input is a differential input to an A/D. The full scale differential command input range is $\pm 13V$.*

3.5 DACMap Parameters

IDN 32814 DM1Map selects the signal sent to the DAC Monitor 1 output on J2-4. This IDN should be set so that:
IDN 32814 = Monitor # from the table on the following page.

IDN 32815 DM2Map selects the signal sent to the DAC Monitor 2 output on J2-5. This IDN should be set so that:
IDN 32815 = Monitor # from the table on the following page.
Note: *Set the value of the DM1Map and DM2Map (IDNs 32814 and 32815) before setting the values of DM1Gain and DM2Gain (IDNs 32812 and 32813).*

IDN 32812 DM1Gain sets the multiplicative scale factor applied to the DM1Map selected signal before outputting on DAC Monitor 1 (J2-4) (DM1Gain). This IDN should be set so that:
IDN 32812 = DM1Gain

IDN 32813 DM2Gain sets the multiplicative scale factor applied to the DM1Map selected signal before outputting on DAC Monitor 2 (J2-5) (DM2Gain). This IDN should be set so that:
IDN 32813 = DM2Gain

DAC Out units The table below lists the units when DMxGain = 1.

| Monitor # | Variable | Description | DAC Out Units |
|-----------|------------|---------------------------------------|---------------------|
| 0 | AnalogOutX | | 0.001 V/V |
| 1 | VelFB | Measured Velocity (DM2 Default) | 0.001 V/kRPM |
| 2 | VelCmdA | Actual Velocity Command (VelCmdA) | 0.001 V/kRPM |
| 3 | VelErr | Velocity Error | 0.001 V/kRPM |
| 4 | FVelErr | Compensated Velocity Error | 0.001 V/kRPM |
| 5 | Position | Measured Position* | 0.001 V/Rev |
| 6 | PosError | Position Error* | 0.001 V/Rev |
| 7 | PosCommand | Commanded Position* | 0.001 V/Rev |
| 8 | ICmd | Commanded Torque Current | 0.001 V/A |
| 9 | IFB | Measured Torque Current (DM1 Default) | 0.001 V/A |
| 10 | AnalogIn | Filtered A/D Input | 0.001 V/V |
| 11 | EncFreq | Encoder Frequency | 0.001 V/Hz |
| 12 | EncPos | Encoder Position* | 0.010 V/4096 counts |
| 13 | ItFilt | Filtered Output Current Amplitude | 0.001 V/100% |
| 14 | HSTemp | Measured Heat Sink Temperature | 0.001 V/C |
| 15 | | Commutation Electrical Angle* | 0.001V/Cycle |
| 16 | IR | Motor Phase R Output Current | 0.001 V/A |
| 17 | IS | Motor Phase S Output Current | 0.001 V/A |
| 18 | IT | Motor Phase T Output Current | 0.001 V/A |
| 19 | | Motor Phase R Voltage Duty Cycle | 0.001V/100% |
| 20 | | Motor Phase S Voltage Duty Cycle | 0.001V/100% |

Table (cont'd)

| Monitor # | Variable | Description | DAC Out Units |
|------------------|---|----------------------------------|----------------------|
| 21 | | Motor Phase T Voltage Duty Cycle | 0.001V/100% |
| 22 | VBus | Drive Bus Voltage | 0.001 V/V |
| 23 | ResPos | Resolver Absolute Position* | 0.001 V/Rev |
| 24 | | Commanded non-torque current | 0.001 V/A |
| 25 | | Measured non-torque current | 0.001 V/A |
| 26 | | Torque Voltage Duty Cycle | 0.001 V/100% |
| 27 | | Non-Torque Voltage Duty Cycle | 0.001 V/100% |
| 28 | | Velocity Command (VelCmd) | 0.001 V/kRPM |
| 65536 | No change to variable, turn range clamp off | | |
| 65537 | No change to variable, turn range clamp on | | |

* - These variables are allowed to wrap around when the signal exceeds the output voltage range.

Note: *Dac monitor outputs have a range of $\pm 5V$ with a resolution of $10V/256 = 0.039 V$.*

Example

To view the velocity feedback (VelFB) signal on an oscilloscope (to measure overshoot, rise-time, or other motion performance parameters) do the following:

1. Command a 4 KRPM move. VelFB is the default setting for DM2Map (IDN 32815 = 1), therefore use DAC Monitor 2 (J2-5 with respect to pin 5).
2. To filter out noise, set DM2F0 (IDN 32811) to 1000 Hz. DAC Monitor 2 will display an analog signal representing VelFB.
3. Set DM2Gain (IDN 32813). The range of the DAC Monitors is ± 5 volts. Set DM2Gain so that the signal is not clamped and a high resolution signal is maintained.

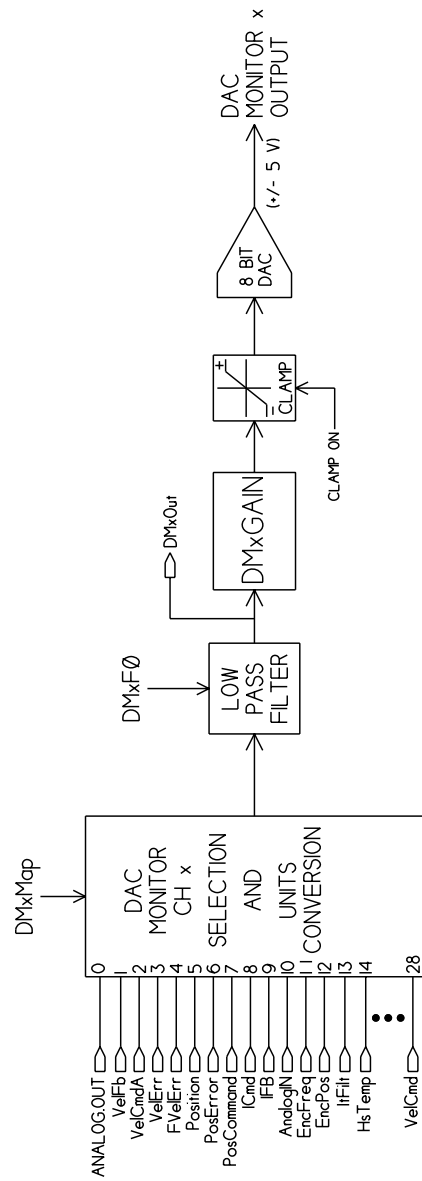
For example, set DM2Gain so that 5 KRPM will correspond to 5 volts:

$$5 \text{ KRPM} * 0.001 \text{ Volt/KRPM} * \text{DM2Gain} = 5 \text{ Volts.}$$

This implies that $\text{DM2Gain} = 1000$.

4. Connect the scope probe to DAC Monitor 2 and command a move. The velocity feedback signal should be visible on the scope.

DACMap diagram



4 Servo Loop Parameters

Introduction

This chapter describes setting parameters associated with the current, velocity and position loops. In some cases the user must adjust control loop parameters due to large mismatches between motor and load inertia, mechanical resonance, backlash, etc. This chapter provides guidance for handling these situations.

Note: *The two anti-resonant zeroes (ARZ0 and ARZ1) are assumed to both be off (set to zero) for this discussion.*

4.1 Current Loop

IDN 106 Current Loop Proportional Gain (Kip). This IDN should be set so that:

$$\text{Kip V/Amp} = L_{t1} \text{ (in henries)} * 2 * \pi * 1000$$

$$\text{IDN 106} = \text{Kip (Volts/Amp)} * I_{\text{Peak}} * 405.6685\text{e-3}$$

IDN 107 Current Loop Integral Gain (Kii). This IDN should be set so that:

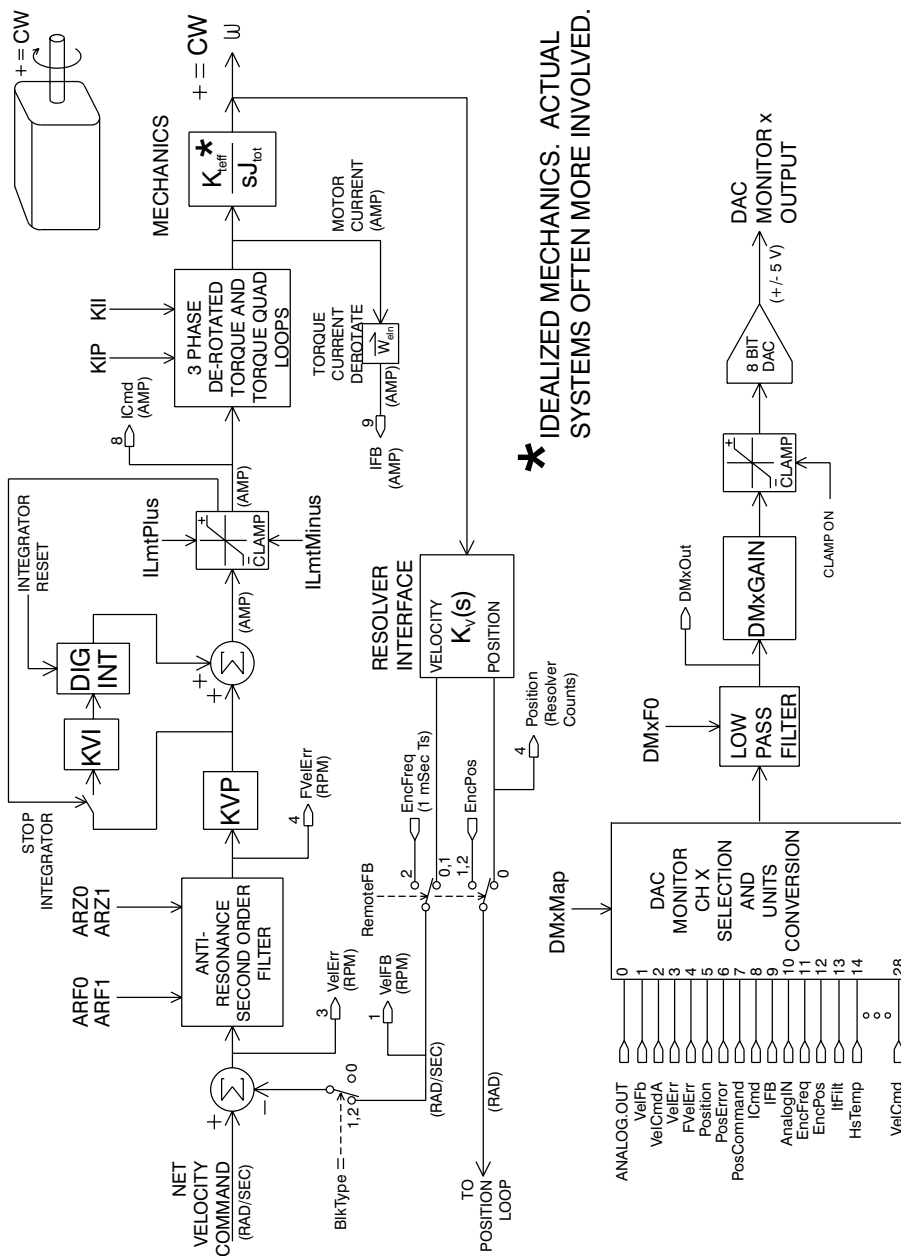
$$\text{Kii} = 50 \text{ Hz}$$

$$\text{IDN 107} = \text{Kii (Hz)} * 12.868$$

4.2 Velocity Loop

Velocity loop bandwidth is the key indicator of system performance. Systems with fast settling time must have high velocity loop bandwidth. Conversely, if the velocity loop bandwidth is low, attempting to achieve fast settling time by increasing the position loop bandwidth, KPP, leads to overshoot and ringing.

Velocity Loop



Velocity loop bandwidth

The velocity loop bandwidth (f_{vc}) is given by the equation:

$$f_{vc} (Hz) = \frac{KVP * K_T \sqrt{3}/2}{2p * J_{TOT}} \approx 0.138 * KVP * \frac{K_T}{J_{TOT}}$$

where:

KVP is the velocity loop proportional gain in amps/(rad/sec)

K_T is the 0-peak line-line motor torque constant in lb-in/amp

J_{TOT} is the total inertia (motor total + load total) in lb-in-sec².

(Any consistent set of units for K_T , J_{TOT} , such as MKS, that yields K_T/J_{TOT} in rad/sec²/amp will work)

The motor torque constant is the value of K_T peak published in the HighPerformance Servo Motors catalog.

Note: f_{vc} is the unity gain open-loop crossover frequency of the idealized rigid single mass system. See hardware specifications for maximum f_{vc} value.

Load inertia

From the formula for bandwidth, it is seen that bandwidth changes inversely with total inertia. If the load inertia equals the motor plus resolver inertia, the velocity loop bandwidth will be half the values shown. If the load inertia is ten times the motor plus resolver inertia, the bandwidths will be one eleventh these values. Clearly KVP must be increased to compensate for increased load inertia if bandwidth is to be maintained. Typically, load inertia up to 3(motor + resolver) give acceptable performance without further optimization.

The most common servo setup problem is adding large load inertia without a corresponding increase in KVP.

KVP

The value of KVP to achieve a desired bandwidth can easily be calculated as follows:

$$KVP = \frac{2p * f_{vc} * J_{TOT}}{K_{TRMS} \frac{\sqrt{3}}{2\sqrt{2}}} \approx 10.26 * f_{vc} * \frac{J_{TOT}}{K_{TRMS}}$$

Example calculation

For example, to achieve 75 Hz bandwidth with a PMA22 motor having 20 to 1 load inertia = 0.011 lb-in-sec²:

$$J_{TOT}^1 = 0.00039 + 0.011 = 0.01139 \text{ lb-in-sec}^2$$

$$K_T^2 = 4.31 \text{ lb-in/amp}$$

$$KVP = 10.26 * 75 * \frac{0.01139}{4.31} = 2.03$$

There is no specific answer to the general question “What should the bandwidth be?” In general, the higher the velocity loop bandwidth, the faster the settling time will be and the better the rejection of torque disturbances (increased stiffness). Typically, velocity loop bandwidths range from 30 to 100 Hz. However, too high a bandwidth can lower the damping of resonance in mechanical linkages, causing excessive ringing and/or wear in coupled mechanics. Remember, it is the resulting motion at the end of any mechanical linkages that typically matters, not the response at the motor shaft.

- 1 Motor plus resolver inertia (0.00039 lb-in-sec²) for the PMA22 motor can be found in the catalog.
- 2 K_T can be found in the catalog as $K_{T\text{RMS}}$ (4.31 lb-in/amp) or by using the Back EMF Constant, K_E (31.2 Volts/kRPM) in the following formula:

$$K_{T\text{RMS}} = K_{E\text{RMS}} * \frac{1.06}{\sqrt{3}} \text{ (volts/krpm).}$$

$$K_{T0\text{-PK}} = K_{T\text{RMS}} * 0.707$$

IDN 100

Velocity Loop Proportional Gain (Kvp). This IDN should be set so that:

$$Kvp \text{ (Amps/rad/sec)} = 2\pi * f_{vc} \text{ (Hz)} * J_{total} / K_{teff} \text{ (rad/sec}^2\text{/amp)}$$

$$IDN 100 = Kvp \text{ (Amps/rad/sec)} / (I_{Peak} * 193.38e-6)$$

where:

J_{total} = Load inertia reflected to the motor shaft + motor inertia (lb-in-s²)

f_{vc} = velocity loop bandwidth (Hz)

K_{teff} = torque constant (effective)

Problems with high load inertia

It would seem that setting KVP is simply a matter of increasing its value to compensate for load inertia. Unfortunately, the following problems often interfere, particularly when the load inertia is large compared with the motor's inertia:

1. Mechanical resonance between motor and load cause high frequency oscillation.
2. Backlash between motor and load effectively unload the motor over a small angle. Within this small angle the increased bandwidth results in oscillation.
3. Ripple in the velocity feedback signal results in large motor ripple current if KVP is large.

As a general rule, any system with KVP set higher than 5 times the medium bandwidth setting will require adjustment to the default ARF0 and ARF1 settings.

Resonance

Mechanical resonance is caused by springiness between motor inertia and load inertia. This may result from belts, flexible couplings, or the torsional stiffness of shafts. **In general, the stiffer the couplings, the higher the resonance frequency and the easier it is to tune the system for good performance.**

If the velocity loop breaks into an oscillation at a frequency well above the calculated velocity loop bandwidth, a resonance problem may well exist. A second symptom is that the frequency of oscillation is relatively constant in the presence of changes to ARF0 and ARF1.

Anti-resonance Filters

Two digital anti-resonance filters, ARF0 (IDN 32843) and ARF1 (IDN 32844) are included in the velocity loop. These filters attenuate the velocity loop gain at the mechanical resonant frequency.

Recommended values are shown below:

| | | | |
|----------------------------|-----------|-----------|-------------------|
| f_{vc} (Hz) | 25 | 75 | 200 |
| ARF0 (Hz) | 100 | 150 | 1500 |
| ARF1 (Hz) | 200 | 750 | 1x10 ⁵ |

ARZ0 (IDN 32841) and ARZ1 (IDN 32842) are generally not needed and should be set to zero, which eliminates them entirely. However, for advanced compensation, ARZ0 or ARZ1 can be used to add lead compensation or used together to add a notch filter.

ARZ0 positive sets the zero frequency in Hz. If ARZ0 is less than zero, ARZ0 sets the under damped zero pair frequency in Hz and ARZ1 sets the under damped pair Q.

IDN 32841

First velocity loop compensation zero. This IDN should typically be set to ARZ0 (Hz/100) = 0.

The units of ARZ0 are 0.01 Hz.

IDN 32842

Second velocity loop compensation zero. This IDN should typically be set to ARZ1 (Hz/100) = 0.

The units of ARZ1 are 0.01 Hz.

IDN 32843

First velocity loop compensation anti-resonance low-pass filter corner frequency. This IDN should be set so that:

$$\begin{aligned} \text{IDN 32843} &= \text{ARF0 (Hz)} * 100 \\ &= 10000 \text{ for Gentle Response,} \\ &= 15000 \text{ for Medium Response,} \\ &\text{and} = 150000 \text{ for Stiff Response} \end{aligned}$$

IDN 32844

Second velocity loop compensation anti-resonance low-pass filter corner frequency. This IDN should be set so that:

$$\begin{aligned} \text{IDN 32844} &= \text{ARF1 (Hz)} * 100 \\ &= 20000 \text{ for Gentle Response,} \\ &= 75000 \text{ for Medium Response,} \\ &\text{and} = 10000000 \text{ for Stiff Response} \end{aligned}$$

Procedure

If the velocity loop bandwidth cannot be raised to an acceptable value without encountering a resonant oscillation, the following procedure is recommended.

1. Set both ARF0 and ARF1 to 400 Hz and set KVP low enough to prevent oscillation.
2. Increase KVP slowly until oscillation at the resonant frequency just begins. Then, reduce KVP slightly until the oscillation just stops. Compute the velocity loop bandwidth using the formula given at the beginning of this section. If the velocity loop bandwidth is less than .25 times the value of ARF0 and ARF1, then proceed to Step 3. Otherwise, go to Step 4.
3. Decrease both ARF0 and ARF1 by 20% and go back to Step 2.
4. The velocity loop bandwidth should now be approximately one quarter the value of ARF0 and ARF1. For margin, reduce KVP, ARF0, and ARF1 by 20%.

Backlash

Some backlash may be unavoidable, especially when gear reduction is used. If backlash is present, the inertia match must be good (load inertia should be roughly equal to motor inertia) for good servo performance. Gearing reduces the inertia reflected to the motor by the square of the gear reduction from motor to load. Therefore, select a gear ratio to give the required match.

Current ripple

The velocity feedback signal in standard PC840 drives operating with the standard 20 arcmin resolver can have up to 3% p-p ripple. The resulting motor torque current ripple, with no ARF0/ARF1 filtering, can be calculated using the following formula:

$$\begin{aligned} \text{Current ripple (amps p-p)} &= \frac{3}{100} * \text{Speed (RPM)} * \frac{2p}{60} * KVP \\ &\approx 0.003 * \text{Speed (RPM)} * KVP \end{aligned}$$

There can be cause for concern when this p-p number exceeds 40% of the drive's or motor's current rating. The motor current should be monitored using Dac Monitors on J2-4 to insure actual ripple current, with ARF0/ARF1 filtering, is not excessive.

Motor current ripple can often be reduced by lowering the ARF0, ARF1 low-pass filter break frequencies. This benefit is limited by velocity loop bandwidth and stability constraints. Velocity feedback ripple, and hence motor current ripple, can also be reduced by specifying a higher accuracy resolver.

KVI

The parameter KVI sets the so called "lag-break" frequency of the velocity loop. KVI is equal to the frequency in Hz where the velocity loop compensation transitions from predominantly integral characteristics to predominantly proportional characteristics. Drive rejection of torque disturbances increase as KVI increases. Default values for KVI are shown below:

| f_{vc} (Hz) | 25 | 75 | 200 |
|---|-----------|-----------|------------|
| KVI (Velocity Loop Lag-Break Freq. (Hz)) | 1.7 | 5.0 | 13.3 |

IDN 101

Velocity Loop Integral Gain (Kvi). This IDN should be set so that:

$$Kvi = f_{vc} (\text{Hz}) / 15$$

$$\text{IDN 101} = Kvi (\text{Hz}) * 51.4719$$

If the drive is to be used within a position loop (either with `BlkType = 2` or when using an external position drive and `BlkType = 1`), `KVI` should be equal to or less than 0.1 times the velocity loop bandwidth. If no position loop is used, `KVI` can be set to 0.25 times the velocity loop bandwidth (or higher if some ringing can be tolerated). In general, the response to a velocity command step (or truncated ramp) will have velocity overshoot for non-zero values of `KVI`.

4.3 Position Loop

When `BlkType` is set equal to 2, a position loop is configured outside the velocity loop. **The velocity loop must be set up and evaluated in terms of bandwidth before attempting to setup the position loop.**

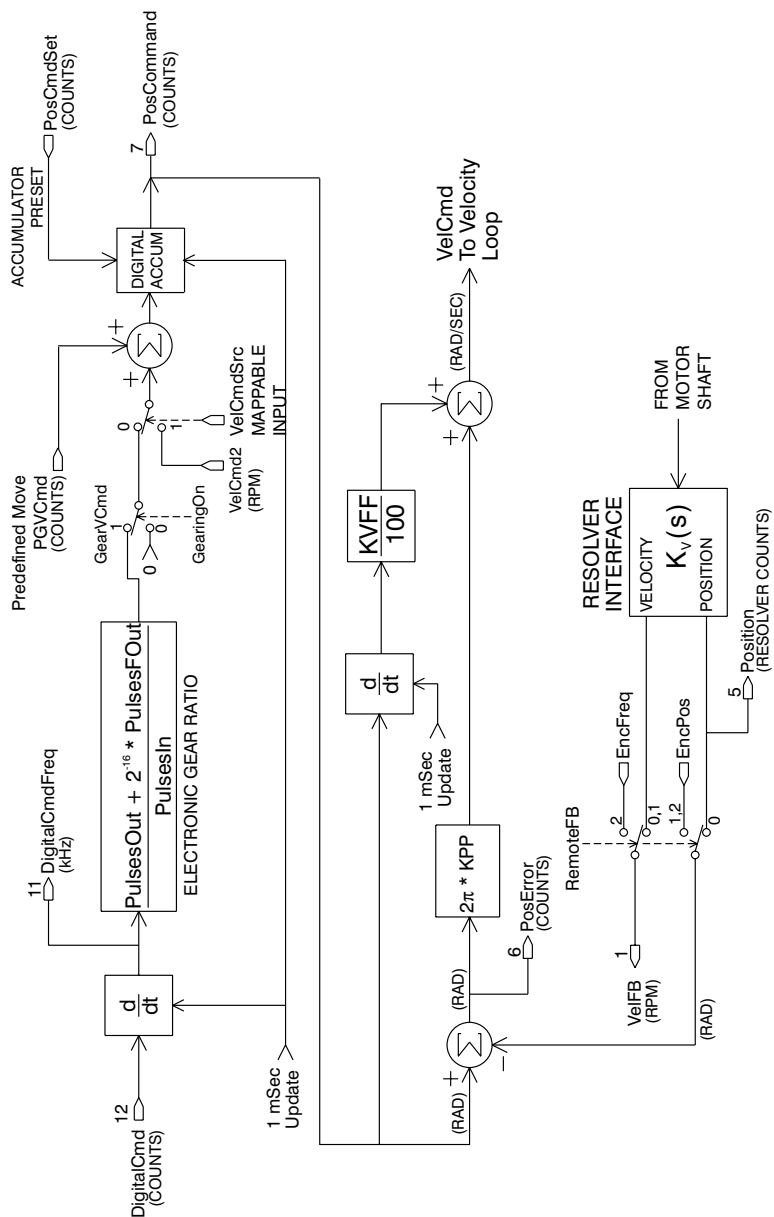
KPP

The position loop proportional gain, `KPP`, determines the settling time of the position loop. `KPP` is the bandwidth of the position loop, in Hz, assuming an ideal velocity loop. Recommended values for `KPP` are shown below:

| f_{vc} (Hz) | 25 | 75 | 200 |
|---|----|--------------|-----|
| KPP (Position Loop Bandwidth (Hz)) | 5 | 15 (default) | 50 |

In general, the higher the value of `KPP`, the faster the settling time. However, **trying to set `KPP` to a high value with inadequate velocity loop bandwidth results in overshoot and ringing.** A good trade off is to set `KPP` to 0.2 times the velocity loop bandwidth. Slightly higher values can be used if overshoot can be tolerated.

Position Loop



IDN 104

Position Loop Proportional Gain (Kpp). This IDN should be set according to table below. Gain settings are determined by the response type: Gentle, Medium, or Stiff.

| Response | f _{vc} | IDN 101 (Kvi) | IDN 32843 (ARF0) | IDN 32844 (ARF1) | IDN 104 (Kpp) |
|----------|-----------------|---------------|------------------|------------------|---------------|
| Gentle | 25 | 172 | 10000 | 20000 | 2056 |
| Medium | 75 | 515 | 15000 | 75000 | 6167 |
| Stiff | 250 | 1716 | 150000 | 10,000,000 | 20556 |

IDN 104 = Kpp (Hz) / 2.4324e-3
(for Resolver Feedback - IDN 32824 = 0)

IDN 104 = 4 * Kpp (Hz) / 2.4324e-3
(for Encoder Feedback - IDN 32824 = 1 or 2)

Note: *Kpp sets the position loop bandwidth for all values of RemoteFB (IDN 32824).*

KVFF

KVFF is the velocity feed forward gain. In the absence of velocity feed forward ($KVFF = 0$), the commanded velocity is proportional to the position (following) error. This means that the actual position will lag the commanded position by a value proportional to the speed. The error will be smaller for larger values of KPP.

The following table gives a feel for the following error magnitude.

| Speed (RPM) | KPP (Hz) | Following Error (revolutions) |
|-------------|----------|-------------------------------|
| 1000 | 10 | 0.27 |
| 2000 | 10 | 0.53 |
| 5000 | 10 | 1.33 |
| 1000 | 20 | 0.13 |
| 2000 | 20 | 0.27 |
| 5000 | 20 | 0.66 |

Note: *The following error can easily exceed one complete motor revolution. In many electronic gearing applications, such following errors are not acceptable (real gears don't have following errors!) Also, stepper systems don't have such errors.*

Feed forward takes advantage of the fact that the PC840 DSP knows the frequency of the encoder or step inputs and hence knows how fast the motor should be going at a given instant. All or part of this velocity can be added to the velocity command to reduce following error. If KVFF is set to 100 (%), then the steady state following error reduces to zero.

IDN 32840

This IDN should be set so that:

$$\text{IDN 32840} = \text{Kvff (\%)} * 10$$

Note: Increasing Kvff reduces steady state following error (position loop null error proportional to speed) and gives faster response time. However, if Kvff is too large, it will provide overshoot. Typically Kvff should not be set larger than 80 for smooth dynamics and acceptable overshoot, but should be set to 100 for minimum following error, which may be necessary in some applications.

Overshoot

Setting KVFF equal to 100% can result in position overshoot. Somewhat lower values may be required if this is a problem. KVFF set to 70%-80% typically achieves the fastest step response with no overshoot. However, setting KVFF to less than 100% will give steady state following error when running at constant speed.

4.4 Advanced Velocity Loop Tuning

Continuous time transfer function approximation

The transfer function for the velocity loop compensation block is given below:

$$\frac{FVelErr}{VelErr}(s) = \frac{\left(\frac{s}{w_z}\right)^2 + \frac{1}{Q_z} \frac{s}{w_z} + 1}{\left(\frac{s}{w_f}\right)^2 + \frac{1}{Q_f} \frac{s}{w_f} + 1}$$

$$\frac{ICmd}{VelErr}(s) = \frac{\left(\frac{s}{w_z}\right)^2 + \frac{1}{Q_f} \frac{s}{w_z} + 1}{\left(\frac{s}{w_f}\right)^2 + \frac{1}{Q_f} \frac{s}{w_f} + 1}$$

For $ARx0 > 0$ both roots are real and:

$$w_x = 2\pi\sqrt{(ARx0)(ARx1)}$$

$$Q_x = \frac{\sqrt{(ARx0)(ARx1)}}{ARx0 + ARx1}$$

For $ARx0 < 0$ roots are a complex pair and:

$$w_x = -2\pi ARx0$$

$$Q_x = ARx1$$

Note: When $ARZ0$ and $ARZ1$ are both zero, the numerator of $\frac{FVelErr}{VelErr}(s)$ reduces to 1. If $ARZ0$ or $ARZ1$ is individually 0 the

numerator reduces to $\frac{s}{2\pi ARZx} + 1$.

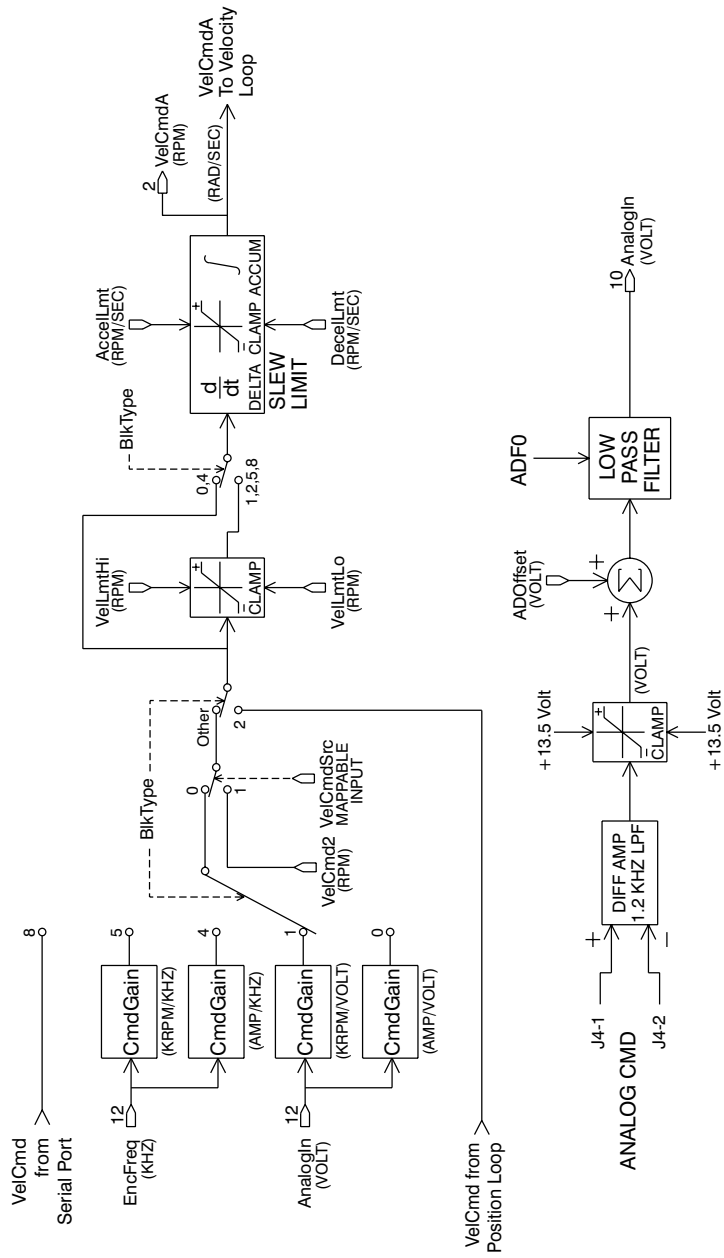
Discrete time
transfer function

The velocity loop compensation is actually implemented as a digital discrete time system function on the DSP. The continuous time transfer function is converted to the discrete time domain by a backward Euler mapping:

$$s \rightarrow \frac{1}{T_s} (1 - z^{-1})$$

where $T_s = 250 \mu\text{sec}$.

Mode Selection and Command processing



5 IDN Attributes

Introduction This section contains a list of Identification Numbers (IDNs) in numerical order.

5.1 SERCOS Specific Parameters

IDN 1: Control unit cycle time Parameter Data IDN
Unsigned Decimal Number

Sercos Cycle Rate. This is the update rate for AT and MDT IDNs. This value must be at least 1000 (1 mSec) for Velocity mode, and 2000 (2 mSec) for Position mode operation. The maximum value is 64000 (64 mSec).

Conversion Scaling Factor: 1
Data Length: 2 bytes
Units: μs
Minimum Value: 01000
Maximum Value: 64000
Master Read (Phase 2): Always reads 0xFA00 - 64 mSec - Current value.
Master Read (Phase 3 or 4): Value written to this drive while in Phase 2.
Master Write: This IDN can only be written in Phase 2.

IDN 2: Communication cycle time

Parameter Data IDN

Unsigned Decimal Number

This value must be the same as IDN 1 - Control unit cycle time.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 01000 |
| Maximum Value: | 64000 |
| Access State: | Read/Write in Phase 2. Read Only in Phase 3 and 4. |

IDN 3: Shortest AT Transmission starting time

Parameter Data IDN

Unsigned Decimal Number

Time required by the PC840 after the MST before it is able to send the AT.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 20 |
| Maximum Value: | 20 |
| Access State: | Read Only by the Master. |

IDN 4: Transmit/receive transition time

Parameter Data IDN

Unsigned Decimal Number

Time required by the PC840 after the end of transmitting the AT before it is ready to receive the MDT from the master.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 20 |
| Maximum Value: | 20 |
| Access State: | Read Only by the Master. |

IDN 5: Minimum feedback processing time

Parameter Data IDN

Unsigned Decimal Number

Time required by the PC840 to acquire and compile the AT data prior to the MST.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 300 |
| Maximum Value: | 300 |
| Access State: | Read Only by the Master. |

IDN 6: AT transmission starting time

Parameter Data IDN

Unsigned Decimal Number

The time the PC840 sends the AT after the end of the MST, as measured in μ Sec. This value is calculated and written by the Master during Phase 2. The value read back is always the current value.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μ s |
| Minimum Value: | 20 |
| Maximum Value: | 64000 |
| Access State: | Read/Write in Phase 2. Read Only in Phase 3 and 4. |

IDN 7: Feedback acquisition capture point

Parameter Data IDN

Unsigned Decimal Number

The PC840 shall acquire the AT data at this time. This value is calculated and written by the master during phase 2. The value read back is always the current value.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μ s |
| Minimum Value: | 0 |
| Maximum Value: | 63700 |
| Access State: | Read/Write in Phase 2. Read Only in Phase 3 and 4. |

IDN 8: Command value valid time

Parameter Data IDN

Unsigned Decimal Number

At this moment of time, the PC840 shall begin using the data received from the master in the MDT. This value is calculated and written by the master during phase 2.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 0 |
| Maximum Value: | 64000 |
| Access State: | Read/Write in Phase 2. Read Only in Phase 3 and 4. |

IDN 9: Position of data record in MDT

Parameter Data IDN

Unsigned Decimal Number

Position within the MDT that the drive's data begins. This value is in bytes and must be an odd value. This value is calculated and written by the master during phase 2.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 65531 |
| Access State: | Read/Write in Phase 2. Read Only in Phase 3 and 4. |

IDN 10: Length of MDT

Parameter Data IDN

Unsigned Decimal Number

The length of the MDT in bytes. This includes data records for all drives. This value is calculated and written by the master during phase 2.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 4 |
| Maximum Value: | 65534 |
| Access State: | Read/Write in Phase 2. Read Only in Phase 3 and 4. |

IDN 11: Class 1 diagnostic

Parameter Data IDN

Binary Data

This IDN reports back the status of the motor/drive. The fault reported in this IDN causes the PC840 to disable the drive. Clearing the fault is required before the motor can be enabled. The PC840 supports the following bits in this IDN:

| Bit Number | Description |
|------------|---|
| Bit 15 | Manufacturer Specific Fault See IDN 129 for additional information |

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0x8000 |
| Access State: | Read Only by the Master. |

IDN 14: Interface status

Parameter Data IDN

Binary Data

This IDN reports back the Communication Interface Status. The PC840 supports the following bits in this IDN:

| Bit Number | Description |
|------------|----------------------------------|
| Bits 0-2 | Phase - Indicates current phase. |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 0x0007
Access State: Read Only by the Master.

IDN 15: Telegram type parameter

Parameter Data IDN

Binary Data

This IDN indicates which set of IDNs are to be supported in the AT and MDT. The PC840 supports the following parameter configurations (0 - 7 inclusive):

Configuration 0 : No AT or MDT IDNs.

Configuration 4 : IDN 47 (Position Command) in the MDT
IDN 51 (Position Feedback) in the AT.

Configuration 7 : User defined AT and MDT. Refer to IDNs 16 and 24.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 7
Access State: Read/Write in Phase 2.
Read Only in Phase 3 and 4.

IDN 16: Configuration list of AT

Parameter Data IDN

IDN ID Number List

List of IDNs which are to be included in a User Defined AT. The data contained in this list is governed by the following restrictions:

Each IDN must be included in the list of Valid AT IDNs (Refer to IDN 187).

Total number of AT IDNs must be 8 or less.

Total number of bytes transferred must be 20 or less.

This IDN must be written when IDN 15 = 7. (Custom Telegram)

Conversion Scaling Factor: 1

Data Length: 2 Bytes data - Variable Length

Access State: Read/Write in Phase 2.
Read Only in Phase 3 and 4.

IDN 17: IDN list of all operation data

Parameter Data IDN

IDN ID Number List

The Master receives a list of valid IDNs when this IDN is read.

Conversion Scaling Factor: 1

Data Length: 2 Bytes data - Variable Length

Access State: Read Only by the Master.

IDN 18: IDN list of operation data for CP2

Parameter Data IDN

IDN ID Number List

List of required operational data which must be received by the PC840 before a change to phase 3 can proceed.

Note: *A valid waveshape must exist prior to phase 3. The PC840 has a default value which allows access into phase 3. Partially overwriting the waveshape will prevent access into CP3.*

Conversion Scaling Factor: 1

Data Length: 2 Bytes data - Variable Length

Access State: Read Only by the Master.

IDN 19: IDN list of operation data for CP3

Parameter Data IDN

IDN ID Number List

List of required operational data which must be received by the PC840 before a change to phase 4 can proceed.

Conversion Scaling Factor: 1

Data Length: 2 Bytes data - Variable Length

Access State: Read Only by the Master.

IDN 21: IDN list of invalid operation data for CP2

Parameter Data IDN

IDN ID Number List

List of required operational data which has not been received by the PC840 before a change in phase to phase 3 can proceed.

Conversion Scaling Factor: 1

Data Length: 2 Bytes data - Variable Length

Access State: Read Only by the Master.

IDN 22: IDN list of invalid operation data for CP3 Parameter Data IDN
IDN ID Number List

List of required operational data which has not been received by the PC840 before a change in phase to phase 4 can proceed.

Conversion Scaling Factor: 1
Data Length: 2 Bytes data - Variable Length
Access State: Read Only by the Master.

IDN 24: Configuration list of MDT Parameter Data IDN
IDN ID Number List

List of IDNs which are to be included in a User Defined MDT. The data contained in this list is governed by the following restrictions:

Each IDN must be included in the list of Valid MDT IDNs (Refer to IDN 188).

Total number of MDT IDNs must be 8 or less.

Total number of bytes transferred must be 20 or less.

This IDN must be written when IDN 15 = 7. (Custom Telegram)

Conversion Scaling Factor: 1
Data Length: 2 Bytes data - Variable Length
Access State: Read/Write in Phase 2.
Read Only in Phase 3 and 4.

IDN 25: IDN list of all procedure commands Parameter Data IDN
IDN ID Number List

List of all COMMAND IDNs (Reset Fault, Home, etc.) supported by the PC840.

Conversion Scaling Factor: 1
Data Length: 2 Bytes data - Variable Length
Access State: Read Only by the Master.

IDN 28: MST Error Counter

Parameter Data IDN

Unsigned Decimal Number

Counts all invalid MSTs in communication phases 3 and 4.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 65535
Access State: Read by the Master.
Write only 0.

IDN 29: MDT Error Counter

Parameter Data IDN

Unsigned Decimal Number

Counts all invalid MDTs in communication phase 4.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 65535
Access State: Read by the Master.
Write only 0.

IDN 30: Manufacturer Version

Parameter Data IDN

Text Data String

The operation data of the manufacturer version contains the constant string "Pacific Scientific."

Conversion Scaling Factor: 1
Data Length: 1 Byte data - Variable length
Access State: Read Only by the Master.

IDN 32: Primary operation mode

Parameter Data IDN

Unsigned Decimal Data

The mode of operation is sent by the Master to the PC840 during Phase 2 with this IDN. Valid modes of operation are velocity, position and torque mode.

Mode 1: Torque Mode - Allows the use of IDN 80 (Torque Command) over the Service Channel to control torque of drive.

Mode 2 : Velocity Mode - Allows use of IDN 36 (Velocity Command) over the Service Channel to control speed of drive.

Mode 3 : Position Mode - Allows use of IDN 47 (Position Command) over the Cyclic and Service Channel to control position of drive.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 1 |
| Maximum Value: | 3 |
| Access State: | Read/Write in Phase 2. Read Only in Phase 3 and 4. |

IDN 36: Velocity command value

Parameter Data IDN

Signed Decimal Number

Gives access to the instantaneous Velocity Command value of the PC840.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units | Motor velocity (RPM) / [(IDN 45)*10 ^{^(IDN 46)}] |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Master Read: | Reads the instantaneous Velocity Command from the PC840. |

IDN 36 continued

Master Write: **Position Mode:** Always overwritten by new Velocity Command generated from the Position Command.
Velocity Mode: Sets the Velocity Command of the PC840.

Access State: Read/Write in phases 2-4.

IDN 40: Velocity feedback value Parameter Data IDN
Signed Decimal Number

Gives access to the instantaneous Velocity Feedback value of the PC840.

Conversion Scaling Factor: 1
Data Length: 4 bytes
Units Motor velocity (RPM) / [(IDN 45)*10^{^(IDN 46)}]
Minimum Value: -2,147,483,647
Maximum Value: 2,147,483,647
Master Read: Reads the instantaneous Velocity Feedback from the PC840.

IDN 41: Homing velocity Parameter Data IDN
Signed Decimal Number

Sets the velocity a home command is processed at. For example, if IDN 45 = 1, IDN 46 = -3, then LSB weight of IDN 41 = 0.001 RPM.

Conversion Scaling Factor: 1
Data Length: 4 bytes
Units Motor velocity (RPM) / [(IDN 45)*10^{^(IDN 46)}]
Minimum Value: -2,147,483,647
Maximum Value: 2,147,483,647
Access State: Read/Write in phases 2-4.

IDN 42: Homing acceleration

Parameter Data IDN

Unsigned Decimal Number

Sets the acceleration a home command is processed at. For example, if IDN 161 = 1 and IDN 162 = -3 then LSB weight of IDN 42 = 0.001 RPM/Sec.

Conversion Scaling Factor : 1
Data Length: 4 bytes
Units: Motor acceleration (RPM/Sec)/
[(IDN 161*10[^](IDN 162))]
Minimum Value: 1
Maximum Value: 4,294,967,295
Access State: Read/Write in phases 2-4.

IDN 43: Velocity polarity parameter

Parameter Data IDN

Binary Data

Defines the polarity of the velocity data (IDNs 36 and 40).

| Bit Number | Bit Setting (1 = Inverted, 0 = Non-Inverted) |
|-------------|---|
| Bit 0 | Controls Velocity Command Data |
| Bit 1 | Must be zero |
| Bit 2 | Controls Velocity Feedback Data |
| Bits 3 - 15 | Reserved and must be zero. |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0x0
Maximum Value: 0x0005
Access State: Read/Write in phases 2-4.

IDN 44: Velocity data scaling type

Parameter Data IDN

Binary Data

Defines the scaling type for the PC840. For the PC840, IDN 44 = 0xA.

| Bit Number | Bit Setting |
|------------|--------------------------|
| Bits 0-2 | 010 : Rotational Scaling |
| Bit 3 | 1 : Parameter Scaling |
| Bit 4 | 0 : Revolutions |
| Bit 5 | 0 : Minutes |
| Bit 6 | 0 : At the Motor Shaft |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0xA
Maximum Value: 0xA
Access State: Read Only by the Master.

IDN 45: Velocity data scaling factor

Parameter Data IDN

Unsigned Decimal Number

All velocity data (IDNs 36, 40 and 41) are scaled by the following formula:
 $(IDN\ 45) * 10^{(IDN\ 46)}$.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 1
Maximum Value: 65535
Access State: Read/Write by the Master.

IDN 46: Velocity data scaling exponent

Parameter Data IDN

Signed Decimal Number

All velocity data (IDNs 36, 40 and 41) are scaled using the following formula:
(IDN 45)*10^{^(IDN 46)}.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | -32768 |
| Maximum Value: | 32767 |
| Access State: | Read/Write by the Master. |

IDN 47: Position command value

Parameter Data IDN

Signed Decimal Number

Allows the Master to have access to the instantaneous Position Command value of the PC840 drive. The value is scaled by IDN 79.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | resolver or encoder counts * (65536 / (IDN 79)) (depending on feedback device used) |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Master Read: | Reads the instantaneous Position Command Value. |
| Master Write: | Sets the instantaneous Position Command Value. This value will be overwritten by the Position Feedback Data when the drive is not enabled. This value sent over the Service Channel will be overwritten by any applicable cyclic channel data. |
| Access State: | Read/Write in phases 2-4. |

IDN 51: Position feedback value 1

Parameter Data IDN

Signed Decimal Number

Allows the Master to have access to the instantaneous Position Feedback value of the PC840 drive. The value is scaled by IDN 79.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | resolver or encoder counts * ((IDN 79) / 65536) (depending on feedback device used) |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Master Read: | Reads the instantaneous Position Command Value. |

IDN 52: Reference distance 1

Parameter Data IDN

Signed Decimal Number

Programmable Position offset used during Home Commands. The value is scaled by IDN 79.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | resolver or encoder counts * (65536 / (IDN 79)) (depending on feedback device used) |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read/Write in phases 2-4. |

IDN 55: Position polarity parameter

Parameter Data IDN

Binary Data

Defines the Position Polarity Parameters.

| Bit Number | Bit Setting (1 = Inverted, 0 = Non-Inverted) |
|-------------------|--|
| Bit 0 | Position Command Data (IDN 47). |
| Bit 1 | Must be zero. |
| Bit 2 | Position Feedback Data (IDN 51). |
| Bit 3 | Must be zero. |
| Bit 4 | Must be zero. |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 5
Access State: Read in phases 2-4.
Write in phase 2.

IDN 76: Position data scaling type

Parameter Data IDN

Binary Data

Defines the position scaling type for the PC840.

| Bit Number | Bit Setting |
|------------|--|
| Bits 0-2 | 010 : Rotational Scaling. |
| Bit 3 | 1 : Parameter Scaling. |
| Bit 4 | 0 : Degrees. |
| Bit 5 | 0 : Reserved. |
| Bit 6 | 0 : At the Motor Shaft. |
| Bit 7 | 0/1 : 0 => Absolute Format. 1 => Modulo Format (IDN 103). |

Note: Only Bit 7 may be changed by the Master while in phase 2. All other bits are Read Only, trying to change them results in a Service Channel error.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0x0A
Maximum Value: 0x8A
Access State: Read/Write in phase 2
Read Only in phase 4.

IDN 77: Linear position data scaling factor

Parameter Data IDN

Unsigned Decimal Number

All position data IDNs (IDNs 47, 51, 52, 103, 130, 131, 132, 133, 159, and 189) are scaled according to the formula $(IDN\ 77) * 10^{(IDN\ 78)}$.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 1 |
| Maximum Value: | 65535 |
| Access State: | Read Only by the Master. |

IDN 78: Linear position data scaling exponent

Parameter Data IDN

Signed Decimal Number

All position data IDNs (IDNs 47, 51, 52, 103, 130, 131, 132, 133, 159 and 189) are scaled according to the formula $(IDN\ 77) * 10^{(IDN\ 78)}$.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | -32,768 |
| Maximum Value: | 32,767 |
| Access State: | Read Only by the Master. |

IDN 79: Rotational position resolution

Parameter Data IDN

Unsigned Decimal Number

All position data is scaled using IDN 79. Command IDNs (IDNs 47, 52, 103) are scaled by $(65536 / (\text{IDN } 79))$. Feedback IDNs (IDNs 51, 130, 131, 132, 133, 189) are scaled by $((\text{IDN } 79 / 65536))$. If $\text{IDN } 79 = 32768$ counts per revolution, the position data is scaled by $65536 / 32768 = 2$ or $32768 / 65536 = 1/2$. If $\text{IDN } 47 = 1000 \text{ units} * 2 = 2000 \text{ units}$. If $\text{IDN } 51 = 3000 \text{ units} * 1/2 = 1500 \text{ units}$.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | percent |
| Minimum Value: | 0 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read/Write in phases 2-4. |

IDN 80: Torque command value

Parameter Data IDN

Signed Decimal Number

Gives access to the instantaneous torque value of the PC840.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 0.009 Amps (1000 = 9 Amps) |
| Data Length: | 2 bytes |
| Minimum Value: | -32768 |
| Maximum Value: | 32767 |
| Master Read: | Reads the instantaneous current command of the PC840. |
| Master Write: | Position and Velocity Mode: Always overwritten by new current command generated by the velocity loop. |
| | Torque Mode: Sets the current command of the PC840. |
| Access State: | Read/Write in phases 2-4. |

IDN 82: Positive torque limit value

Parameter Data IDN

Unsigned Decimal Number

Value of IlmtPlus corresponds to the clockwise direction of the motor and is set in % increments.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | percent of peak current rating of the drive |
| Minimum Value: | 0 |
| Maximum Value: | 100 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 83: Negative torque limit value

Parameter Data IDN

Unsigned Decimal Number

Value of IlmtMinus corresponds to the counter-clockwise direction of the motor is % increments.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | percent of peak current rating of drive |
| Minimum Value: | 0 |
| Maximum Value: | 100 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 84: Torque feedback value

Parameter Data IDN

Signed Decimal Number

Gives access to the instantaneous Torque Feedback Value of the PC840.

Conversion Scaling Factor: 0.009 Amps (1000 = 9 Amps)**Data Length:** 2 bytes**Minimum Value:** -32768**Maximum Value:** 32767**Access State:** Read Only by the Master.**IDN 85: Torque polarity parameter**

Parameter Data IDN

Binary Data

Defines the Torque Polarity Parameters.

| Bit Number | Bit Setting (1 = Inverted, 0 = Non-Inverted) |
|-------------------|--|
| Bit 0 | Torque command value |
| Bit 1 | Additive Torque command value - Must be zero |
| Bit 2 | Torque feedback value |
| Bits 3-15 | Reserved and must be zero |

Conversion Scaling Factor: 1**Data Length:** 2 bytes**Minimum Value:** 0**Maximum Value:** 5**Access State:** Read/Write in phase 2.
Read Only by the Master in Phases 3-4.

IDN 88: Receive to receive recovery time

Parameter Data IDN

Unsigned Decimal Number

Required time for the PC840 between the end of the MDT and the beginning of the next MST.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 350 |
| Maximum Value: | 350 |
| Access State: | Read Only by the Master. |

IDN 89: MDT transmission starting time

Parameter Data IDN

Unsigned Decimal Number

Value sent by the Master to indicate the starting time in uSec of the MDT. This value is calculated and written by the master during phase 2.

| | |
|-----------------------------------|--------------------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 1 |
| Maximum Value: | 64000 |
| Access State: | Read/Write by the Master in Phase 2. |

IDN 90: Command value proceeding time

Parameter Data IDN

Unsigned Decimal Number

Value read by the Master indicating how soon after the MDT the PC840 can make the received data available for usage.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | μs |
| Minimum Value: | 1 |
| Maximum Value: | 64000 |
| Access State: | Read Only by the Master. |

IDN 95: Diagnostic message

Parameter Data IDN

Text Data String

The diagnostic messages are generated by the drive as text and stored in the operation data of this IDN. If IDN 129 = 0x0314 (Faultcode = 20 and ExtFault = 3) the diagnostic message will be "Initialization Fault. Calibration data corrupted. Fatal Fault."

| | |
|-----------------------------------|-------------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 1 Byte data - Variable Length |
| Access State: | Read Only by the Master. |

IDN 96: Slave Arrangement 0

Parameter Data IDN

Binary Data

The PC840 returns its axis address in both the low and high byte of this IDN. The PC840 is not capable of supporting multiple motors on a single drive. Valid axis addresses range from 0x01 to 0xFE (1 - 254 decimal).

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0x0101 |
| Maximum Value: | 0xFEFE |
| Access State: | Read Only by the Master. |

IDN 99: Reset class 1 diagnostic

Command Data IDN

Unsigned Decimal Number

Command Procedure IDN : Used to clear recorded faults in the PC840. Faults which cause the PC840 to cycle back to phase 0 are recorded and saved for transmission in phase 2. The PC840 will automatically notify the Master upon completion of this Command IDN. While this Command IDN is being performed, other service channel IDNs may be processed. Write 3 to IDN 99 to initiate Reset Class 1 Diagnostics (this will reset the fault and disable the drive). Write 0 to IDN 99 to de-activate the fault reset command. The drive cannot be enabled while fault reset is asserted.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 3 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 100: Velocity loop proportional gain

Parameter Data IDN

Unsigned Decimal Number

Allows the master to set the value of kvp (Amp/rad/sec).
 $IDN\ 100 = kvp / (I_{peak} * 193.38e-6)$.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 65534 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 101: Velocity loop integral gain

Parameter Data IDN

Unsigned Decimal Number

Allows the master to set the value of kvi (Hz). $IDN\ 101 = kvi * 51.4719$.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 1 |
| Maximum Value: | 65535 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 103: Modulo value

Parameter Data IDN

Unsigned Decimal Number

If bit 7 of IDN 76 is set to modulo format, the modulo value defines the range that the drive and control must implement. This IDN is scaled by IDN 79.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Modulo value * (65536 / (IDN 79)) |
| Minimum Value: | 10 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read/Write in phase 2. Read Only in phases 3 and 4. |

IDN 104: Position loop Kp-factor

Parameter Data IDN

Unsigned Decimal Number

Allows the master to set the value of kpp (Hz).
IDN 104 = kpp / 2.4324e-3 (for resolver feedback).
IDN 104 = 4 * kpp / 2.4324e-3 (for encoder feedback).

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 65534 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 106: Current Loop Proportional Gain 1

Parameter Data IDN

Unsigned Decimal Number

Allows the master to set the value of kip (Volts/Ampere).

$$\text{IDN 106} = \text{kip} * \text{Ipeak} * 405.6685\text{e-3.}$$

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 62000 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 107: Current Loop Integral Action Time 1

Parameter Data IDN

Unsigned Decimal Number

Allows the master to set the value of kii (Hz). $\text{IDN 107} = \text{kii} * 12.868.$

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 65535 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 110: Amplifier peak current

Parameter Data IDN

Unsigned Decimal Number

Contains the amplifier peak current. Set to 30,000 mA as default.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | mA |
| Minimum Value: | 0 |
| Maximum Value: | 4,294,967,295 |
| Access State: | Read Only by the Master. |

IDN 127: Command Data IDN

Communication phase 3 transition check Binary Data

Command Procedure IDN used to check whether the PC840 is ready to proceed into phase 3. This IDN must be performed and successfully completed prior to going into phase 3. If all IDNs identified in IDN 18 have not been completed, or if the waveshape is incomplete, or if this IDN is not performed and the Master goes to phase 3, the PC840 will declare a fault and go to phase 0.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 3
Access State: Read/Write by the Master in phase 2.

IDN 128: Command Data IDN

Communication phase 4 transition check Binary Data

Command Procedure IDN used to check whether the PC840 is ready to proceed into phase 4. This IDN must be performed and successfully completed prior to going into phase 4. If not all IDNs identified in IDN 19 have not been completed or if this IDN is not performed and the Master goes to phase 4, the PC840 will declare a fault and go to phase 0.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 3
Access State: Read/Write by the Master in phase 3.

IDN 129: Manufacturer Class 1 Diagnostic

Parameter Data IDN

Binary Data

The data in this IDN contains the current manufacturer specific fault code. If no fault is present in the PC840, this value will be zero.

The low byte of the data is the Fault Code that is displayed on the PC840 drive.

The high byte of the data is the Extended Fault Code. If the fault code has an associated extended fault code, it will be displayed here. Most fault codes do not have extended fault codes.

| FaultCode | Fault Description |
|------------------|--|
| 1 | Velocity feedback (VelFB) over speed* |
| 2 | Motor over temperature |
| 3 | User +5V low |
| 4 | Continuous current fault |
| 5 | Drive over current (instantaneous) |
| 6 | Control ± 12 V under voltage |
| 7 | Not Assigned |
| 9 | Bus over voltage detected by DSP, External Regen Fault |
| 10 | Not Assigned |
| 11 | Bus under voltage* (Only if VBus < VBusThresh) |
| 12 | Ambient temperature too low |
| 13 | Encoder alignment failed* |
| 14 | Software and non-volatile memory versions not compatible |
| 15 | Hardware not compatible with software version |
| 16 | UnConfigured drive fault |
| 17 | Two AInNull events too close together |
| 18 | Position following error fault |
| 19 | Parameter memory error* |
| 20 | Initialization fault* |
| 21 | Drive over temperature |
| 22 | Resolver Fault |

*To further identify this fault see software ExtFault table.

IDN 129 continued**ExtFault** The following table lists the values for ExtFault.

| ExtFault | ExtFault Description |
|-----------------|---|
| 1 | Absolute Resolver Overspeed. $ \text{VelFB} > 21038 \text{ RPM}$ |
| 2 | Variable Resolver Overspeed. $ \text{VelFB} > \max(\text{VelLmtxx}) * 1.5$ |
| 3 | Calibration data corrupted* |
| 4 | Excessive dc offset in current feedback sensor* |
| 5 | DSP incompletely reset by line power dip* |
| 8 | Excessive dc offset in Analog Command A/D* |
| 9 | Not Assigned |
| 10 | DSP stack overflow* |
| 12 | Software and control card ASIC incompatible* |
| 13 | Actual Model not same as stored in NV memory* |
| 14 | Unable to determine power stage* |
| 15 | Drive non-volatile parameters corrupt* |
| 16 | RAM failure* |
| 17 | Calibration RAM failure* |
| 18 | Encoder alignment: no motion fault |
| 19 | Encoder alignment: excessive motion fault |
| 20 | Encoder alignment: motor not settled |
| 21 | Encoder alignment: test failed |
| 22 | Encoder alignment: motion overflow fault |
| 23 | Hall Commutation: invalid configuration |
| 24 | Hall Commutation: overspeed |
| 25 | Hall Commutation: invalid hall state |
| 26 | Hall Commutation: invalid hall transition |
| 27 | I*t Drive |
| 28 | I^2*t Motor |

IDN 129 continued

Ext Fault continued

| ExtFault | ExtFault Description |
|-----------------|-----------------------------|
| 29 | DP RAM Test A * |
| 30 | DP RAM Test 5 * |
| 31 | DP RAM Test Run 1* |
| 32 | DP RAM Test Run 0 * |
| 33 | DP RAM Test C * |
| 65 | Data Read Only |
| 66 | Data Bounds Error |
| 67 | Execute no such command |
| 68 | RT not Implemented |
| 69 | FC not Implemented |

*These fault states CANNOT be reset with the Fault Reset function and require the line control power to be turned OFF and ON again.

IDN 130: Probe value 1 positive edge

Parameter Data IDN

Signed Decimal Number

Returns the position value latched by the PC840 drive when a rising edge of the Probe 1 signal has occurred. The position is either in resolver or encoder counts depending on the feedback device used to close the position loop. This value is scaled using IDN 79.

| | |
|-----------------------------------|---------------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Probe Value *((IDN 79) / 65536) |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read Only by the Master. |

IDN 131: Probe value 1 negative edge

Parameter Data IDN

Signed Decimal Number

Returns the position value latched by the PC840 drive when a falling edge of the Probe 1 signal has occurred. The position is either in resolver or encoder counts depending on the feedback device used to close the position loop. This value is scaled using IDN 79.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Probe Value *((IDN 79) / 65536) |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read Only by the Master. |

IDN 132: Probe value 2 positive edge

Parameter Data IDN

Signed Decimal Number

Returns the position value latched by the PC840 drive when a rising edge of the Probe 2 signal has occurred. The position is either in resolver or encoder counts depending on the feedback device used to close the position loop. This value is scaled using IDN 79.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Probe Value *((IDN 79) / 65536) |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read Only by the Master. |

IDN 133: Probe value 2 negative edge

Parameter Data IDN

Signed Decimal Number

Returns the position value latched by the PC840 drive when a falling edge of the Probe 2 signal has occurred. The position is either in resolver or encoder counts depending on the feedback device used to close the position loop. This value is scaled using IDN 79.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Probe Value *((IDN 79) / 65536) |
| Minimum Value: | 2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read Only by the Master. |

IDN 134: Master Control Word

Parameter Data IDN

Unsigned Decimal Number

| | |
|-----------------------------------|----------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 65536 |
| Access State: | Read Only by Master. |

IDN 135: Drive Status Word

Parameter Data IDN
Unsigned Decimal Number

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 65536
Access State: Read Only by Master.

IDN 140: Controller Type

Parameter Data IDN
Text Data String

Allows the Master to read a TEXT description of the drive model number (PC843).

Conversion Scaling Factor: 1
Data Length: 1 Byte data - Variable length

IDN 142: Application Type

Parameter Data IDN
Text Data String

Allows the Master to read a TEXT description of the Application (Pacific Scientific Drive).

Conversion Scaling Factor: 1
Data Length: 1 Byte data - Variable length

IDN 143: SYSTEM Interface Version

Parameter Data IDN
Text Data String

Allows the Master to read a TEXT description of the SERCOS specification which the PC840 was designed to : V01.02

Conversion Scaling Factor: 1
Data Length: 1 Byte data - Variable length

IDN 147: Homing parameter

Parameter Data IDN

Binary Data

Defines the HOME parameters used by the PC840.

| Bit Number | Bit Setting |
|---|--|
| Bit 0: Home Direction | 0 => Positive/Clockwise Direction 1 => Negative/Counter Clockwise Direction |
| Bit 1: Position Feedback Marker Pulse | 0 => First Marker Pulse after Positive Edge of Home Switch 1 => First Marker Pulse after Negative Edge of Home Switch |
| Bit 2: Home Switch : Connected to Drive | Must be 1. |
| Bit 3: Homing : Using Motor Feedback | Must be 0. |
| Bit 4: Interpretation in the drive : Homing Enable Only | Must be 1. |
| Bit 5: Evaluation of Home Switch | 0 => Home Switch evaluated 1 => Home Switch not evaluated. |
| Bit 6: Evaluation of Position Feedback Marker Pulse | 0 => Marker Pulse evaluated 1 => Marker Pulse not evaluated. |

Note: Only Bits 0, 1, 5 and 6 may be changed by the Master while in phases 2-4. All other bits are Read Only, trying to change them results in a Service Channel error.

Note: Writing 0x77 to IDN 147 makes the current motor position the home (zero) position.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0x0014
Maximum Value: 0x0077
Access State: Read/Write by Master in phases 2-4.

IDN 148: Drive controlled homing procedure

Command Data IDN

Binary Data

Command Procedure IDN used to initiate a Home event on the PC840. During the Home event, all velocity and position data received from the Master is ignored with the exception of Home Velocity (IDN 41) and Home Acceleration (IDN 42). Once the drive has finished the HOME event, the Position Feedback Value Status will be set (IDN 403). The Master must read the new position at this time and begin sending updated Position Commands prior to finishing this Command IDN to avoid Excessive Position Error Faults.

Note: *To execute homing more than once, reset IDN 148 by writing 0 and then 3.*

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 (deactivate drive controlled homing) |
| Maximum Value: | 3 (activate drive controlled homing) |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 159: Monitoring Window

Parameter Data IDN

Unsigned Decimal Number

Sets the Maximum Position Deviation allowed by the PC840.

| | |
|-----------------------------------|-------------------------------------|
| Conversion Scaling Factor: | 16 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 65535 |
| Access State: | Read/Write by Master in phases 2-4. |

IDN 160: Acceleration data scaling type

Parameter Data IDN

Binary Data

Defines the scaling type for the PC840.

| Bit Number | Bit Setting |
|------------|--------------------------|
| Bits 0-2 | 010 : Rotational Scaling |
| Bit 3 | 1 : Parameter Scaling |
| Bit 4 | 0 : Radian |
| Bit 5 | 0 : Seconds |
| Bit 6 | 0 : At the motor shaft. |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0x0A
Maximum Value: 0x0A
Access State: Read Only by the Master.

IDN 161: Acceleration data scaling factor

Parameter Data IDN

Unsigned Decimal Number

All acceleration data is scaled by the following formula:

$$(\text{IDN } 161) * 10^{(\text{IDN } 162)}$$

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 1
Maximum Value: 65535
Access State: Read/Write by the Master in phases 2-4

IDN 162: Acceleration data scaling exponentParameter Data IDN
Signed Decimal Number

All acceleration data is scaled by the following formula:

$$(\text{IDN 161}) * 10^{(\text{IDN 162})}$$

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: -32766
Maximum Value: 32765
Access State: Read/Write by the Master in phases 2-4.

IDN 169: Probe control parameterParameter Data IDN
Binary Data

Defines the PROBE parameters used by the PC840.

| Bit Number | Bit Setting |
|------------------------------|--|
| Bit 0: Probe 1 Positive Edge | 0 => Positive edge is not active. 1 => Positive edge is active. |
| Bit 1: Probe 1 Negative Edge | 0 => Negative edge is not active. 1 => Negative edge is active. |
| Bit 2: Probe 2 Positive Edge | 0 => Positive edge is not active. 1 => Positive edge is active. |
| Bit 3: Probe 2 Negative Edge | 0 => Negative edge is not active. 1 => Negative edge is active. |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 0x0F
Access State: Read/Write by Master in phases 2-4.

IDN 170: Probing cycle procedure command

Command Data IDN

Binary Data

Command Procedure IDN used to initiate PROBE events on the PC840. While this IDN is active, all probe events described in IDN 169, and enabled by IDN 405 and 406 are allowed to be recorded. This command must be activated in order for PROBE events to occur. Please refer to Chapter 3 for additional information.

Note: *To activate probing, write 3 to IDN 170.*

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 3
Access State: Read/Write by the Master in phases 2-4.

IDN 185:

Parameter Data IDN

Length of the configurable data record in the AT Unsigned Decimal Number

Maximum number of bytes allowed in the AT as configurable data is 20 bytes.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 65535
Access State: Read Only by the Master.

IDN 186: Parameter Data IDN
Length of the configurable data record in the MDT Unsigned Decimal Number
 Maximum number of bytes allowed in the MDT as configurable data is 20 bytes.
Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 65535
Access State: Read Only by the Master.

IDN 187: Parameter Data IDN
IDN list of the configurable data in the AT IDN ID Number List
 List of IDNs available for entry into the AT configuration list.

| IDN | IDN Description |
|------------|-----------------------------|
| 40 | Velocity Feedback |
| 51 | Position Feedback |
| 84 | Torque Feedback |
| 130 | Probe Value 1 Positive Edge |
| 131 | Probe Value 1 Negative Edge |
| 132 | Probe Value 2 Positive Edge |
| 133 | Probe Value 2 Negative Edge |
| 189 | Following Distance |
| 400 | Home Switch |
| 32857 | Resolver Position |
| 32878 | Digital Command Counts |
| 32879 | Digital Command Frequency |
| 34824 | Input Port |
| 34825 | Analog Input |
| 34826 | Encoder Position |

IDN 187 continued

Conversion Scaling Factor: 1
Data Length: 2 Bytes data - Variable Length
Access State: Read/Write by Master in phases 2-4.

IDN 188: Parameter Data IDN
IDN list of the configurable data record in the MDT IDN ID Number List
List of IDNs available for entry into the MDT configuration list.

| IDN | IDN Description |
|------------|------------------------|
| 36 | Velocity Command |
| 47 | Position Command |
| 80 | Torque Command |
| 32880 | Analog Output 1 |
| 32881 | Analog Output 2 |
| 34840 | Output Port |

Conversion Scaling Factor: 1
Data Length: 2 Bytes data - Variable Length
Access State: Read Only by the Master.

IDN 189: Following Distance

Parameter Data IDN

Signed Decimal Number

Allows the Master to read the current instantaneous Position Error. This value is scaled by IDN 79.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Following Distance * ((IDN 79) / 65536) |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read Only by the Master. |

IDN 192: IDN list of backup operation data

Parameter Data IDN

IDN ID Number List

List of IDNs stored to and from non-volatile memory.

| IDN | IDN Description |
|------------|-------------------------------------|
| 15 | Telegram Type Parameter |
| 32 | Primary Operation Mode |
| 41 | Homing Velocity |
| 42 | Homing Acceleration |
| 55 | Position Polarity Parameter |
| 76 | Position Data Scaling Type |
| 82 | Positive Torque Limit Value |
| 83 | Negative Torque Limit Value |
| 100 | Velocity Loop Proportional Gain |
| 101 | Velocity Loop Integral Action Time |
| 103 | Modulo Value |
| 104 | Position Loop Kv Factor |
| 106 | Current Loop Proportional Gain 1 |
| 107 | Current Loop Integral Action Time 1 |

IDN 192 continued List of IDNs stored to and from non-volatile memory.

| | |
|-------|-------------------------|
| 140 | Controller Type |
| 147 | Homing Parameter |
| 159 | Monitoring Window |
| 32807 | Pole Count |
| 32809 | Filter Value for ADF0 |
| 32810 | DM1F0 |
| 32811 | DM2F0 |
| 32812 | DM1Gain |
| 32813 | DM2Gain |
| 32814 | DM1Map - Mux Select |
| 32815 | DM2Map - Mux Select |
| 32816 | Encoder Output (EncOut) |
| 32817 | InpMap1 |
| 32818 | InpMap2 |
| 32819 | InpMap3 |
| 32820 | InpMap4 |
| 32821 | InpMap5 |
| 32822 | InpMap6 |
| 32823 | EncInFilt |
| 32824 | RemoteFB |
| 32826 | CommOff |
| 32828 | Encoder Input (EncIn) |
| 32829 | ITThresh |
| 32830 | StopTime |
| 32831 | VBusThresh |

IDN 192 continued List of IDNs stored to and from non-volatile memory.

| | |
|-------|------------------------------|
| 32832 | VelLmtHi |
| 32833 | VelLmtLo |
| 32835 | CoastTime |
| 32837 | Motor 1 Name |
| 32838 | Motor 2 Name |
| 32840 | Kvff |
| 32841 | ARZ0 |
| 32842 | ARZ1 |
| 32843 | ARF0 |
| 32844 | ARF1 |
| 32846 | Encoder Data Scaling Method |
| 32847 | Encoder Modulo Value |
| 32853 | CommSrc (Commutation Source) |
| 32866 | ADOffset |

Conversion Scaling Factor: 1

Data Length: 2 Bytes data

Access State: Read Only by the Master.

IDN 194: Acceleration Command

Parameter Data IDN

Unsigned Decimal Number

Sets the acceleration rate a velocity command is processed at. Acceleration = Deceleration.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Motor acceleration(RPM/sec) / [(IDN 161)*10 ^{^(IDN 162)}] |
| Minimum Value: | 1 |
| Maximum Value: | 4,294,967,295 |
| Access State: | Read/Write in phases 2-4. |

IDN 263: NVLoad

Command Data IDN

Unsigned Decimal Number

Command Procedure IDN used to load saved IDNs from Non-Volatile (NV) memory to the drive's active memory, whenever the drive is powered on or is in phase 0. The master need not write to these IDNs as part of the drive initialization thereby substantially reducing the time required to bring the SERCOS ring to Phase 4.

This function will only be executed if NVSave was executed.

Note: *Writing 0 to NVSave (IDN 263) DISABLES NVLoad.*

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 3 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 264: NVSave

Command Data IDN

Unsigned Decimal Number

Command Procedure IDN used to copy IDNs to Non-Volatile (NV) memory as defined by IDN 192.

| NVSave | Description |
|---------------|---|
| 0 | NVSave function is NOT performed. NVLoad (IDN 263) is DISABLED. |
| 3 | Performs NVSave function. NVLoad (IDN 263) is ENABLED. |

Conversion Scaling Factor: 1

Data Length: 2 bytes

Minimum Value: 0

Maximum Value: 3

Access State: Read/Write by the Master in phases 2-4.

IDN 301: Allocation of real-time control bit 1

Parameter Data IDN

Unsigned Decimal Number

The Master sends the number of an IDN whose data is a BIT variable. This BIT variable is then sent in the MDT cyclic Real Time Control Bit 1 data. Please refer to Chapter 3 for additional information.

The IDNs which can be used for Real Time Control bits are:

| IDN | IDN Description |
|------------|------------------------|
| 405 | Probe 1 Enable |
| 406 | Probe 2 Enable |
| 34833 | Output Bit #1 |
| 34834 | Output Bit #2 |
| 34835 | Output Bit #3 |
| 34836 | Output Bit #4 |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0 (Off)
Maximum Value: 34836
Access State: Read/Write by Master in phases 2-4.

IDN 303: Allocation of real-time control bit 2

Parameter Data IDN

Unsigned Decimal Number

The Master sends the number of an IDN whose data is a BIT variable. This BIT variable is then sent in the MDT cyclic Real Time Control Bit 2 data. Please refer to Chapter 3 for additional information.

The IDNs which can be used for Real Time Control bits are:

| IDN | IDN Description |
|------------|------------------------|
| 405 | Probe 1 Enable |
| 406 | Probe 2 Enable |
| 34833 | Output Bit #1 |
| 34834 | Output Bit #2 |
| 34835 | Output Bit #3 |
| 34836 | Output Bit #4 |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0 (Off)
Maximum Value: 34836
Access State: Read/Write by Master in phases 2-4.

IDN 305: Allocation of real-time status bit 1

Parameter Data IDN

Unsigned Decimal Number

The Master sends the number of an IDN whose data is a BIT variable. This BIT variable is then sent in the AT cyclic Real Time Status Bit 1 data. Please refer to Chapter 3 for additional information.

The IDNs which can be used for Real Time Status bits are:

| IDN | IDN Description | IDN | IDN Description |
|------------|--------------------------------|------------|------------------------|
| 400 | Home Switch | 34817 | Input Bit #1 |
| 401 | Probe 1 | 34818 | Input Bit #2 |
| 402 | Probe 2 | 34819 | Input Bit #3 |
| 403 | Position Feedback Value Status | 34820 | Input Bit #4 |
| 409 | Probe 1 Positive Latched | 34821 | Input Bit #5 |
| 410 | Probe 1 Negative Latched | 34822 | Input Bit #6 |
| 411 | Probe 2 Positive Latched | | |
| 412 | Probe 2 Negative Latched | | |

Conversion Scaling Factor: 1

Data Length: 2 bytes

Minimum Value: 0 (Off)

Maximum Value: 34822

Access State: Read/Write by Master in phases 2-4.

IDN 307: Allocation of real-time status bit 2

Parameter Data IDN

Unsigned Decimal Number

The Master sends the number of an IDN whose data is a BIT variable. This BIT variable is then sent in the AT cyclic Real Time Status Bit 2 data. Please refer to Chapter 3 for additional information.

The IDNs which can be used for Real Time Status bits are:

| IDN | IDN Description | IDN | IDN Description |
|------------|--------------------------------|------------|------------------------|
| 400 | Home Switch | 34817 | Input Bit #1 |
| 401 | Probe 1 | 34818 | Input Bit #2 |
| 402 | Probe 2 | 34819 | Input Bit #3 |
| 403 | Position Feedback Value Status | 34820 | Input Bit #4 |
| 409 | Probe 1 Positive Latched | 34821 | Input Bit #5 |
| 410 | Probe 1 Negative Latched | 34822 | Input Bit #6 |
| 411 | Probe 2 Positive Latched | | |
| 412 | Probe 2 Negative Latched | | |

Conversion Scaling Factor: 1

Data Length: 2 bytes

Minimum Value: 0 (Off)

Maximum Value: 34822

Access State: Read/Write by Master in phases 2-4.

IDN 400: Home Switch

Parameter Data IDN

Binary Data

Allows the Master to read the current state of the Home Switch. If more than one input is defined to be the Home Switch, the highest Input (1-6) is the value returned.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 1
Access State: Read Only by the Master.

IDN 401: Probe 1

Parameter Data IDN

Binary Data

Allows the Master to read the current state of the Probe 1 switch. The only Input pin which can be defined as Probe 1 is Input 4.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 1
Access State: Read Only by the Master.

IDN 402: Probe 2

Parameter Data IDN

Binary Data

Allows the Master to read the current state of the Probe 2 switch. The only input pin which can be defined as Probe 2 is Input 5.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 403: Position feedback value status

Parameter Data IDN

Binary Data

This bit is set by the PC840 whenever a Home has been successfully completed.

This bit starts off CLEARED upon initialization.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 405: Probe 1 enable

Parameter Data IDN

Binary Data

This bit must be set by the Master (either by Cyclic or Service Channel) in order for Probe 1 Data to be latched. IDN 169 must specify the valid Probe edges to latch and IDN 170 must also be active for Probe 1 data to be latched. Please refer to Chapter 3 for additional information.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 1
Access State: Read/Write by Master.

IDN 406: Probe 2 enable

Parameter Data IDN

Binary Data

This bit must be set by the Master (either by Cyclic or Service Channel) in order for Probe 2 Data to be latched. IDN 169 must specify the valid Probe edges to latch and IDN 170 must also be active for Probe 2 data to be latched. Please refer to Chapter 3 for additional information.

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 1
Access State: Read/Write by Master.

IDN 409: Probe 1 positive latched

Parameter Data IDN

Binary Data

This bit is used to indicate that Probe 1 Positive Edge data has been latched by the PC840. Reading IDN 130 will return the Probe data for this event. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 410: Probe 1 negative latched

Parameter Data IDN

Binary Data

This bit is used to indicate that Probe 1 Negative Edge data has been latched by the PC840. Reading IDN 131 will return the Probe data for this event. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 411: Probe 2 positive latched

Parameter Data IDN

Binary Data

This bit is used to indicate that Probe 2 Positive Edge data has been latched by the PC840. Reading IDN 132 will return the Probe data for this event. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 412: Probe 2 negative latched

Parameter Data IDN

Binary Data

This bit is used to indicate that Probe 2 Positive Edge data has been latched by the PC840. Reading IDN 133 will return the Probe data for this event. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

5.2 Manufacturer Specific Parameters

IDN 32800: DSP Debug Address

Parameter Data IDN

Binary Data

Used for Manufacturer Investigations. Master would write an address to access into this IDN.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read/Write by the Master. |

IDN 32801: DSP Debug Word

Parameter Data IDN

Binary Data

Used for Manufacturer Investigations. Reading this IDN causes the WORD data located in the address specified in IDN 32800 to be read.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read Only by the Master. |

IDN 32802: DSP Debug DWord

Parameter Data IDN

Binary Data

Used for Manufacturer Investigations. Reading the IDN causes the DWORD data located in the address specified in IDN 32800 to be read.

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFFFFFF |
| Access State: | Read Only by the Master. |

IDN 32803 - 32806: ARM Debug Variables

Parameter Data IDN

Binary Data

Used for Manufacturer Investigations. **DO NOT USE.**

IDN 32807: Pole Count

Parameter Data IDN

Unsigned Decimal Number

Number of motor poles used for motor commutation. For encoder based commutation:

$$\text{Polecount} = \frac{\text{Encoder counts / rev}}{(\text{motor poles} / 2)}$$

Note: IDN 32853 (CommSrc) must be set BEFORE IDN 32807. Please refer to Chapter 6 for additional information.

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | motor poles |
| Minimum Value: | 2 |
| Maximum Value: | 32766 |
| Access State: | Read/Write by the Master in phase 2. Read/Write in phases 3 and 4. |

IDN 32809: Filter Value for ADF0

Parameter Data IDN

Unsigned Decimal Number

Sets the filter break frequency for the Analog Input. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | 1 |
| Maximum Value: | 4.17e9 |
| Access State: | Read/Write by the Master. |

IDN 32810: DM1F0

Parameter Data IDN

Unsigned Decimal Number

Sets the filter break frequency for DacMonitor 1. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | 1 |
| Maximum Value: | 4.17e9 |
| Access State: | Read/Write by the Master. |

IDN 32811: DM2F0

Parameter Data IDN

Unsigned Decimal Number

Sets the filter break frequency for DacMonitor 2. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | 1 |
| Maximum Value: | 4,294,967,295 |
| Access State: | Read/Write by the Master. |

IDN 32812: DM1Gain

Parameter Data IDN

Signed Decimal Number

Sets the analog output gain for DacMap 1. Scale factor depends on the setting of DacMap 1. Refer to Dac Monitor Map and Gain Units List. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read/Write by the Master. |

IDN 32813: DM2Gain

Parameter Data IDN

Signed Decimal Number

Sets the analog output gain for DacMap 2. Scale factor depends on the setting of DacMap 2. Refer to Dac Monitor Map and Gain Units List. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Minimum Value: | -2,147,483,647 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read/Write by the Master. |

IDN 32814: DM1Map -Mux Select

Parameter Data IDN

Unsigned Decimal Number

Refer to Dac Monitor Map and Gain Units List. Use the DMxMAP column for the desired function. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 75 |
| Access State: | Read/Write by the Master. |

IDN 32815: DM2Map -Mux Select

Parameter Data IDN

Unsigned Decimal Number

Refer to Dac Monitor Map and Gain Units List. Use the DMxMAP column for the desired function. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 75 |
| Access State: | Read/Write by the Master. |

IDN 32816: EncOut

Parameter Data IDN

Unsigned Decimal Number

Sets the line count of the emulated encoder. Writing 0 to this IDN internally connects the EncIn input pins to the EncOut output buffers.

125, 250, 500, 1000, 2000, 4000, 8000, 16000 lines/rev

128, 256, 512, 1024, 2048, 4096, 8192, 16384 lines/rev

Note: *The number of encoder counts per revolution is equal to 4 * encoder line count.*

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Emulated encoder count |
| Minimum Value: | 0 |
| Maximum Value: | 16384 |
| Access State: | Read/Write by the Master. |

IDN 32817: InpMap1

Parameter Data IDN

Binary Data

Refer to Input Map List, Function Number Column for the desired function.

Set High/Low Polarity bits as required. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read/Write by the Master. |

IDN 32818: InpMap2

Parameter Data IDN

Binary Data

Refer to Input Map List, Function Number Column for the desired function.

Set High/Low Polarity bits as required. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read/Write by the Master. |

IDN 32819: InpMap3

Parameter Data IDN

Binary Data

Refer to Input Map List, Function Number Column for the desired function.

Set High/Low Polarity bits as required. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read/Write by the Master. |

IDN 32820: InpMap4

Parameter Data IDN

Binary Data

Refer to Input Map List, Function Number Column for the desired function.

Set High/Low Polarity bits as required. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read/Write by the Master. |

IDN 32821: InpMap5

Parameter Data IDN

Binary Data

Refer to Input Map List, Function Number Column for the desired function.

Set High/Low Polarity bits as required. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read/Write by the Master. |

IDN 32822: InpMap6

Parameter Data IDN

Binary Data

Refer to Input Map List, Function Number Column for the desired function.

Set High/Low Polarity bits as required. Please refer to Chapter 3 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 0xFFFF |
| Access State: | Read/Write by the Master. |

IDN 32823: EncInFilt

Parameter Data IDN

Unsigned Decimal Number

Sets the break frequency of the input filters on the Encoder Input pins.

Conversion Scaling Factor: 1**Data Length:** 4 bytes**Units:** Hz**Minimum Value:** 50,000**Maximum Value:** 16,000,000**Access State:** Read/Write by Master.

| EncMode | Scaling | Encoder Input Filter Setting | | | |
|----------------|----------------------|------------------------------|--------|--------|--------|
| | | High | Medium | Low | Lowest |
| (0) Quadrature | Max Quadrature Freq. | 1600000 | 800000 | 400000 | 200000 |
| (1) StepDir | Max Step Freq | 800000 | 200000 | 100000 | 50000 |
| (2) Up/Down | Max Step Freq | 800000 | 200000 | 100000 | 50000 |
| (3) Hold Count | N/A | N/A | N/A | N/A | N/A |

IDN 32824: RemoteFB

Parameter Data IDN

Unsigned Decimal Number

Determines the source of Velocity and Position Feedback.

Conversion Scaling Factor: 1**Data Length:** 4 bytes**Minimum Value:** 0**Maximum Value:** 2**Access State:** Read/Write by Master in Phase 2.

| RemoteFB | Velocity Feedback | Position Feedback |
|-----------------|--------------------------|--------------------------|
| 0 | Resolver | Resolver |
| 1 | Resolver | Encoder |
| 2 | Encoder | Encoder |

IDN 32826: CommOff

Parameter Data IDN

Signed Decimal Number

Allows the commutation offset to be set. For Pacific Scientific motors this should be zero. For custom motors, this should be set for proper commutation.

Note: *Negative numbers will be returned as the positive equivalent angle (modulo 360).*

Conversion Scaling Factor: 0.001**Data Length:** 4 bytes**Units:** Electrical degrees**Minimum Value:** -360,000**Maximum Value:** 360,000**Access State:** Read/Write by Master.

IDN 32828: EncIn

Parameter Data IDN

Unsigned Decimal Number

Allows the line count of input encoder to be defined. Must be set when RemoteFB (IDN 32824) = 1 or 2.

Conversion Scaling Factor: 1
Data Length: 4 bytes
Units: Encoder line count
Minimum Value: 1
Maximum Value: 65535
Access State: Read/Write in phase 2
Read Only in phases 3 and 4.

IDN 32829: ITThresh

Parameter Data IDN

Unsigned Decimal Number

Allows the fault threshold for the IT Fault to be adjusted.

Conversion Scaling Factor: 1
Data Length: 4 bytes
Units: percent
Minimum Value: 0
Maximum Value: 100
Access State: Read/Write by Master.

| Pacific Scientific Model Family | Minimum Value | Maximum Value |
|---------------------------------|---------------|---------------|
| 84X | 0 | 60 |

IDN 32830: StopTime

Parameter Data IDN

Unsigned Decimal Number

The StopTime variable is associated with the RunStop I/O Function. It determines the maximum time after RunStop transitions to Stop that it will take the drive to disable. This IDN corresponds to an obsolete function. Do not use.

| | |
|-----------------------------------|-----------------------|
| Conversion Scaling Factor: | 0.001 |
| Data Length: | 2 bytes |
| Units: | seconds |
| Minimum Value: | 2 |
| Maximum Value: | 32,000 |
| Access State: | Read/Write by Master. |

IDN 32831: VBusThresh

Parameter Data IDN

Signed Decimal Number

Allows the Bus Undervoltage threshold to be set. If set to a negative number, turns off the bus undervoltage fault.

| | |
|-----------------------------------|-----------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | Volts |
| Minimum Value: | -1 |
| Maximum Value: | 1,000 |
| Access State: | Read/Write by Master. |

IDN 32832: VelLmtHi

Parameter Data IDN

Signed Decimal Number

Minimum value allowed for the velocity command into the velocity block. Also sets the overspeed fault threshold if $|VelLmtHi| > |VelLmtLo|$.

Overspeed fault set at $1.5 * (\max(|VelLmtHi|, |VelLmtLo|))$

Conversion Scaling Factor: 0.001
Data Length: 4 bytes
Units: RPM
Minimum Value: -21,039,000
Maximum Value: 21,039,000
Access State: Read/Write by Master.

IDN 32833: VelLmtLo

Parameter Data IDN

Signed Decimal Number

Minimum value allowed for the velocity command into the velocity block. Also sets the overspeed fault threshold if $|VelLmtHi| > |VelLmtLo|$.

Overspeed fault set at $1.5 * (\max(|VelLmtHi|, |VelLmtLo|))$.

Conversion Scaling Factor: 0.001
Data Length: 4 bytes
Units: RPM
Minimum Value: -21,039,000
Maximum Value: 21,039,000
Access State: Read/Write by Master.

IDN 32835: CoastTime

Parameter Data IDN

Unsigned Decimal Number

Allows the amount of time the drive will coast for after the bus voltage drops below VBusThresh before generating undervoltage fault.

| | |
|-----------------------------------|-----------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | seconds |
| Minimum Value: | 0 |
| Maximum Value: | 32 |
| Access State: | Read/Write by Master. |

IDN 32836: CommEnbl

Parameter Data IDN

Unsigned Decimal Number

Enables commutation of the motor current based on rotor position. When the drive powers up CommEnbl is set to 1. When CommEnbl is set to 0, the commutation angle of the current flowing in the motor windings is determined by the value of CommOff. When CommEnbl is set to 1, the commutation angle is determined by the sum of CommSrc feedback device electrical angle and the CommOff variable.

| | |
|-----------------------------------|-----------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read/Write by Master. |

IDN 32837: Motor 1 Name

Parameter Data IDN

Binary Data

The Motor variable is a 32-bit long unsigned long integer which is used to identify the waveshape downloaded to the PC840 controller. By convention the 4 ASCII character abbreviation of the motor name is converted to an integer and downloaded along with the waveshape. For example, if this variable is 0x53494E45 = 'S' (0x53) : 'I' (0x49) : 'N' (0x4E) : 'E' (0x45).

Used to assign a label to Wave Shape Generation Table created

Conversion Scaling Factor: 1
Data Length: 4 bytes
Minimum Value: 0
Maximum Value: 0xFFFFFFFF
Access State: Read/Write in Phase 2.
Read Only in Phase 3 and 4.

IDN 32838: Motor 2 Name

Parameter Data IDN

Binary Data

The Motor variable is a 32-bit long unsigned long integer which is used to identify the waveshape downloaded to the PC840 controller. By convention the 4 ASCII character abbreviation of the motor name is converted to an integer and downloaded along with the waveshape.

Used to assign a label to Wave Shape Generation Table created

Conversion Scaling Factor: 1
Data Length: 4 bytes
Minimum Value: 0
Maximum Value: 0xFFFFFFFF
Access State: Read/Write in Phase 2.
Read Only in Phase 3 and 4.

IDN 32840: Kvff

Parameter Data IDN

Unsigned Decimal Number

Allows following error to be reduced when running at a constant speed. When the drive is commanded to run at a constant speed, kvff = 1000 will reduce the steady state following error to zero, but will cause overshoot. A value of 700 is typically used.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.1 |
| Data Length: | 2 bytes |
| Units: | percent |
| Minimum Value: | 0 |
| Maximum Value: | 1,999 |
| Access State: | Read/Write by the Master. |

IDN 32841: ARZ0

Parameter Data IDN

Unsigned Decimal Number

ARZ0 is the first velocity loop compensation zero. Please refer to Chapter 4 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | 20 |
| Maximum Value: | 100,000 |
| Access State: | Read/Write by the Master. |

IDN 32842: ARZ1

Parameter Data IDN

Unsigned Decimal Number

ARZ0 is the second velocity loop compensation zero. Please refer to Chapter 4 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | 20 |
| Maximum Value: | 1,000,000 |
| Access State: | Read/Write by the Master. |

IDN 32843: ARF0

Parameter Data IDN

Signed Decimal Number

ARF0 is the first velocity loop compensation anti-resonance low-pass filter corner frequency. Please refer to Chapter 4 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | -10,000,000 |
| Maximum Value: | 10,000,000 |
| Access State: | Read/Write by the Master. |

IDN 32844: ARF1

Parameter Data IDN

Signed Decimal Number

ARF1 is the second velocity loop compensation anti-resonance low-pass filter corner frequency. Please refer to Chapter 4 for additional information.

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | -10,000,000 |
| Maximum Value: | 10,000,000 |
| Access State: | Read/Write by the Master. |

IDN 32845: Firmware Version

Parameter Data IDN

Text

Allows the Master to read a TEXT description of the current versions for the ARM and the DSP firmware: DSP Version 1.20, ARM version 6.0.

Note: *DSP and ARM versions continue to change with each build.*

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | Byte list |
| Access State: | Read Only by the Master. |

IDN 32846: Encoder Data Scaling Method

Parameter Data IDN

Binary Data

Sets the working parameters for the Encoder Position.

Conversion Scaling Factor: 1

Data Length: 2 bytes

Minimum Value: 0x0A

Maximum Value: 0x18A

Access State: Read/Write in phase 2.
Read Only in Phases 3 and 4.

| Bit Number | Bit Setting (1 = Inverted, 0 = Non-Inverted) |
|-------------------|--|
| Bits 0-2 | 010 : Rotational Scaling. |
| Bit 3 | 1 : Parameter Scaling |
| Bit 4 | 0 : Degrees |
| Bit 5 | 0 : Reserved |
| Bit 6 | 0 : At the Motor Shaft |
| Bit 7 | 0 : Absolute format 1 : Modulo format (IDN 32847) |
| Bit 8 | 0 : Non-Inverted Encoder Data 1 : Inverted Encoder Data |

IDN 32847: Encoder Modulo Value

Parameter Data IDN

Unsigned Decimal Number

Allows the master to set the Encoder Modulo value (IDN 32846).

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 bytes |
| Minimum Value: | 10 |
| Maximum Value: | 2,147,483,647 |
| Access State: | Read/Write in phase 2. Read Only in Phases 3 and 4. |

IDN 32853 : CommSrc

Parameter Data IDN

Unsigned Decimal

Selects between resolver, incremental encoder, or hall encoder feedback for motor commutation.

Note: *CommSrc (IDN 32853) must be set BEFORE PoleCount (IDN 32807).*

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 4 Bytes |
| Minimum Value: | 0 |
| Maximum Value: | 2 |
| Access State: | Read/Write in all phases. |

| CommSrc | Feedback Device |
|----------------|------------------------|
| 0 | Resolver |
| 1 | Encoder |
| 2 | Hall Encoder |

IDN 32857: Resolver Position

Parameter Data IDN

Unsigned Decimal Number

ResPos returns the absolute resolver position within one revolution. The PC840 has 65536 resolver counts per revolution. This IDN will, therefore, return a value between 0 and 65535. This IDN is NOT affected by Position Modulo (IDN 103).

| | |
|-----------------------------------|---|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 65535 |
| Access State: | Read/Write by the Master in phases 2-4. |

IDN 32858: Last Fault

Parameter Data IDN

Signed Decimal Number

Returns the last fault occurred in the drive. The value of this IDN is NOT cleared by a fault reset command. A user can clear Last Fault by explicitly writing 0 to this IDN. See IDN 129 for description of faultcodes.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 22 |
| Access State: | Read Only by the Master in phases 2-4. |

IDN 32859: Last ExtFault

Parameter Data IDN

Signed Decimal Number

Returns the last extended fault occurred in the drive. The value of this IDN is NOT cleared by a fault reset command. A user can clear Last ExtFault by explicitly writing 0 to this IDN. See IDN 129 for description of extended faultcodes.

| | |
|-----------------------------------|--|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 69 |
| Access State: | Read Only by the Master in phases 2-4. |

IDN 32866: ADOffset

Parameter Data IDN

Signed Decimal Number

Adjusts the steady-state value of the analog command input.

| | |
|-----------------------------------|-----------------------|
| Conversion Scaling Factor: | 10,00 |
| Data Length: | 4 bytes |
| Units: | volts |
| Minimum Value: | -150,000 |
| Maximum Value: | 150,000 |
| Access State: | Read/Write by Master. |

IDN 32870: I2tThresh

Parameter Data IDN

Unsigned Decimal Number

Allows I²*t motor protection threshold value. If I2tFilt exceeds I2tThresh, the drive will fault.

| | |
|-----------------------------------|-------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | % of Ipeak ² |
| Minimum Value: | 0 |
| Maximum Value: | 100 |
| Access State: | Read/Write by Master. |

IDN 32871: I2tF0

Parameter Data IDN

Unsigned Decimal Number

I2tF0 sets the low pass filter break frequency for the filter used to implement the I²*t motor drive thermal protection.

I2tF0 and I2tThresh set the thermal protection for the motor. See IDN 32872 (I2tFilt). If I2tFilt exceeds I2tThresh, the drive will fault.

| | |
|-----------------------------------|-----------------------|
| Conversion Scaling Factor: | 0.001 |
| Data Length: | 2 bytes |
| Units: | Hertz |
| Minimum Value: | 1 |
| Maximum Value: | 1,000 |
| Access State: | Read/Write by Master. |

IDN 32872: I2tFilt

Parameter Data IDN

Unsigned Decimal Number

I2tFilt is the filtered value of the square of the currents flowing in the motor:

$I2tFilt = [(IU^2 + IV^2 + IW^2) * 100 / I_{peak}^2]$ low pass filtered by I2tF0 (IDN 32871).

When I2tFilt exceeds the threshold value specified by I2tThresh, the drive will fault.

| | |
|-----------------------------------|----------------------|
| Conversion Scaling Factor: | 0.001 |
| Data Length: | 4 bytes |
| Units: | % of I_{peak}^2 |
| Minimum Value: | 0 |
| Maximum Value: | 100,000 |
| Access State: | Read Only by Master. |

IDN 32875: HallState

Parameter Data IDN

Unsigned Decimal Number

HallState indicates the value of the hall sensors.

$HallState = (4 * Hall\ 3) + (2 * Hall\ 2) + (1 * Hall\ 1)$

| | |
|-----------------------------------|----------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 7 |
| Access State: | Read Only by Master. |

IDN 32876: Offset Angle for Hall Sensors

Parameter Data IDN

Unsigned Decimal Number

HallOffset sets the offset angle for the hall sensors. Hall signals are to be wired as shown in the Pacific Scientific High Performance Servo Drives Catalog. By default it's value is set to 0 degrees.

| | |
|-----------------------------------|-----------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | electrical degrees |
| Minimum Value: | 0 |
| Maximum Value: | 360 |
| Access State: | Read/Write by Master. |

IDN 32878: Digital Command Counts

Parameter Data IDN

Signed Decimal Number

DigitalCmd indicates the position of the external command encoder (J2-17 through J2-20) or the accumulation of step inputs if step-and-direction input format is used. By default it's value is set = 0.

| | |
|-----------------------------------|-------------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Units: | Encoder counts |
| Minimum Value: | -65536 |
| Maximum Value: | 65535 |
| Access State: | Read by Master in all phases. |

IDN 32879: Digital Command Frequency

Parameter Data IDN

Signed Decimal Number

DigitalCmdFreq indicates the frequency of the digital command signal. Is calculated from delta DigitalCmd at position loop update rate. Although the values returned do not have fractional parts this variable is communicated as a floating point quantity. By default it's value is set = 0.

| | |
|-----------------------------------|-------------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Units: | Hz |
| Minimum Value: | -300,000,000 |
| Maximum Value: | 300,000,000 |
| Access State: | Read by Master in all phases. |

IDN 32880: AnalogOut1

Parameter Data IDN

Signed Decimal Number

Allows the Master to set the voltage on Analog Output 1 when DacMap 1 equals zero. The scaling for this IDN is 5/128 Volts per least significant bit (lsb).

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.001 |
| Data Length: | 2 bytes |
| Units: | Volts |
| Minimum Value: | -5,000 |
| Maximum Value: | 4,961 |
| Access State: | Read/Write by the Master. |

IDN 32881: AnalogOut2

Parameter Data IDN

Signed Decimal Number

Allows the Master to set the voltage on Analog Output 2 when DacMap 2 equals zero. The scaling for this IDN is 5/128 Volts per least significant bit (lsb).

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 0.001 |
| Data Length: | 2 bytes |
| Units: | Volts |
| Minimum Value: | -5,000 |
| Maximum Value: | 4,961 |
| Access State: | Read/Write by the Master. |

IDN 32882: Analog Current Limit

Parameter Data IDN

Unsigned Decimal Number

Allows the Master the current limit set (float value) by the Analog Current Limit input (J2-6)

| | |
|-----------------------------------|-------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 2 bytes |
| Units: | % of Ipeak |
| Min: | 0 |
| Max: | 10,000 |
| Access State: | Read only by the Master |

IDN 32883: Analog Current Limit Gain

Parameter Data IDN

Unsigned Decimal Number

AnalogILmtGain allows the Master to set the scale factor (float value) for the Analog Current Limit Input (J2-6).

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 0.001 |
| Data Length: | 4 bytes |
| Units: | % of Ipeak/Volt |
| Min: | 0 |
| Max: | 5,000,000 |
| Access State: | Read/Write by the Master |

IDN 32884: Analog Current Limit Filter

Parameter Data IDN

Unsigned Decimal Number

AnalogILmtFilt allows the Master to set the low-pass filter break frequency (float value) on the Analog Current Limit Input (J2-6).

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 4 bytes |
| Units: | Hertz |
| Min: | 0 |
| Max: | 100,000,000 |
| Access State: | Read/Write by the Master |

IDN 32885: Current Limit Offset Voltage

Parameter Data IDN

Signed Decimal Number

AnalogILmtOffset allows the Master to set the offset (in volts) that is added to the Analog Current Limit Input (J2-6).

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 0.001 |
| Data Length: | 2 bytes |
| Units: | Volts |
| Min: | -10,000 |
| Max: | +10,000 |
| Access State: | Read/Write by the Master |

IDN 32886: Actual Positive Current Limit

Parameter Data IDN

Unsigned Decimal Number

AnalogILmtPlus allows the Master to display the actual positive current limit float value used by the drive.

| | |
|-----------------------------------|-----------------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 2 bytes |
| Units: | % of peak current rating of drive |
| Min: | 0 |
| Max: | 10,000 |
| Access State: | Read only by the Master |

IDN 32887: Actual Negative Current Limit

Parameter Data IDN

Unsigned Decimal Number

AnalogILmtMinus allows the Master to display the actual negative current limit (float value) used by the drive.

| | |
|-----------------------------------|-----------------------------------|
| Conversion Scaling Factor: | 0.01 |
| Data Length: | 2 bytes |
| Units: | % of peak current rating of drive |
| Min: | 0 |
| Max: | 10,000 |
| Access State: | Read only by the Master |

IDN 34817: Input Bit #1

Parameter Data IDN

Binary Data

Allows the Master to read the value of the Input Bit 1 located on J2-31

Note: *User must supply Input Power to have Input Circuitry to operate.*

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 34818: Input Bit #2

Parameter Data IDN

Binary Data

Allows the Master to read the value of the Input Bit 2 located on J2-32.

Note: *User must supply Input Power to have Input Circuitry to operate.*

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 34819: Input Bit #3

Parameter Data IDN

Binary Data

Allows the Master to read the value of the Input Bit 3 located on J2-33 .

Note: *User must supply Input Power to have Input Circuitry to operate.*

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 34820: Input Bit #4

Parameter Data IDN

Binary Data

Allows the Master to read the value of the Input Bit 4 located on J2-34.

Note: *User must supply Input Power to have Input Circuitry to operate.*

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 34821: Input Bit #5

Parameter Data IDN

Binary Data

Allows the Master to read the value of the Input Bit 5 located on J2-35.

Note: *User must supply Input Power to have Input Circuitry to operate.*

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 34822: Input Bit #6

Parameter Data IDN

Binary Data

Allows the Master to read the value of the Input Bit 6 located on J2-36.

Note: *User must supply Input Power to have Input Circuitry to operate.*

| | |
|-----------------------------------|--------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read Only by the Master. |

IDN 34824: Input Port

Parameter Data IDN

Binary Data

Allows the Master to read the entire Input Port. The data returned is in the following format:

| Bit Number | Description | Bit Number | Description |
|------------|-------------|------------|-------------|
| Bit 0 | Input Bit 1 | Bit 4 | Input Bit 5 |
| Bit 1 | Input Bit 2 | Bit 5 | Input Bit 6 |
| Bit 2 | Input Bit 3 | Bits 8-15 | undefined |
| Bit 3 | Input Bit 4 | | |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 0x003F
Access State: Read Only by the Master.

IDN 34825: AnalogIn

Parameter Data IDN

Signed Decimal Number

Allows the master to read the Analog Input on the base unit. Refer to the scaling factor document for the correct Analog Input Scaling.

Conversion Scaling Factor: 0.001
Data Length: 4 bytes
Units: Volts
Minimum Value: -13,500
Maximum Value: 13,500
Access State: Read Only by the Master.

IDN 34826: EncPosParameter Data IDN
Signed Decimal Number

Accumulated Encoder Position.

Conversion Scaling Factor: 1
Data Length: 4 bytes
Units: Encoder counts
Minimum Value: -2,147,483,647
Maximum Value: 2,147,483,647
Access State: Read Only by the Master.

IDN 34833: Output Bit #1Parameter Data IDN
Binary Data

Allows the Master to write the value to Output Bit 1 located on J2-42.
Note: *User must supply Output Power to have Output Circuitry to operate.*

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 1
Access State: Read/Write by the Master.

IDN 34834: Output Bit #2

Parameter Data IDN

Binary Data

Allows the Master to write the value to Output Bit 2 located on J2-43.

Note: *User must supply Output Power to have Output Circuitry to operate.*

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read/Write by the Master. |

IDN 34835: Output Bit #3

Parameter Data IDN

Binary Data

Allows the Master to write the value to Output Bit 3 located on J2-44.

Note: *User must supply Output Power to have Output Circuitry to operate.*

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read/Write by the Master. |

IDN 34836: Output Bit #4

Parameter Data IDN

Binary Data

Allows the Master to write the value to Output Bit 4 located on J2-25.

Note: *User may use Out4 for relay signal. See Section 2 for additional information.*

| | |
|-----------------------------------|---------------------------|
| Conversion Scaling Factor: | 1 |
| Data Length: | 2 bytes |
| Minimum Value: | 0 |
| Maximum Value: | 1 |
| Access State: | Read/Write by the Master. |

IDN 34840: PC840 Output Byte

Parameter Data IDN

Binary Data

Allows the Master to read/write the entire Output Port. The data is in the following format:

| Bit Number | Description |
|-------------|--------------|
| Bit 0 | Output Bit 1 |
| Bit 1 | Output Bit 2 |
| Bit 2 | Output Bit 3 |
| Bit 3 | Output Bit 4 |
| Bits 4 - 15 | undefined |

Conversion Scaling Factor: 1
Data Length: 2 bytes
Minimum Value: 0
Maximum Value: 0x000F
Access State: Read/Write by the Master.

6 Diagnostics and Protection Circuits

Introduction

The drive is fully protected against “normal” abuse and has a seven segment LED on the front panel to indicate SERCOS ring or drive status. The servo drive has the following specific protections:

- Output motor short circuit protection line-to-line and line-to-neutral.
- Interface to Pacific Scientific's standard motor PTC or a normally closed thermostat to sense motor over temperature.
- Internal monitoring of the power stage heat sink temperature for drive over temperature.
- Bus over voltage detection.
- Bus under voltage fault with adjustable threshold.
- Incorporating the measured heat sink temperature there is an excessive current $I \cdot t$ fault. This fault limits the peak current time and intelligently changes the continuous current fault trip dependent on the measured heat sink temperature to limit the continuous output current.
- Control voltage under voltage detection.
- The user +5V output is short circuit to I/O RTN protected.
- The user +24V output is short circuit protected.
- All control outputs are short circuit to I/O RTN protected.
- When a drive is powered up without valid parameters the power stage cannot be enabled and no damage occurs to the drive.

Fault generation The following sequence will occur when the protection circuits generate a fault. The fault source is latched, the output stage is disabled, the Fault mappable output function is activated, and the LED indicates the appropriate fault code. Faults are cleared by activating the Fault Reset input or by turning the AC power OFF and then ON again.

FaultCode List The following table lists the PC840 fault codes.

| FaultCode | Fault Description |
|------------------|--|
| 1 | Velocity feedback (VelFB) over speed* |
| 2 | Motor over temperature |
| 3 | User +5V low |
| 4 | Continuous current fault |
| 5 | Drive over current (instantaneous) |
| 6 | Control ± 12 V under voltage |
| 7 | Not Assigned |
| 9 | Bus over voltage detected by DSP, External Regen Fault |
| 10 | Not Assigned |
| 11 | Bus under voltage* (Only if VBus < VBusThresh) |
| 12 | Ambient temperature too low |
| 13 | Encoder alignment failed* |
| 14 | Software and non-volatile memory versions not compatible |
| 15 | Hardware not compatible with software version |
| 16 | UnConfigured drive fault |
| 17 | Two AInNull events too close together |
| 18 | Position following error fault |
| 19 | Parameter memory error* |
| 20 | Initialization fault* |
| 21 | Drive over temperature |
| 22 | Resolver Fault |

*To further identify this fault see software variable ExtFault.

ExtFault

The following table lists the values for ExtFault.

| ExtFault | ExtFault Description |
|-----------------|---|
| 1 | Absolute Resolver Overspeed. $ VelFB > 21038 \text{ RPM}$ |
| 2 | Variable Resolver Overspeed. $ VelFB > \max(VelLmtxx)*1.5$ |
| 3 | Calibration data corrupted* |
| 4 | Excessive dc offset in current feedback sensor* |
| 5 | DSP incompletely reset by line power dip* |
| 8 | Excessive dc offset in Analog Command A/D* |
| 9 | Not Assigned |
| 10 | DSP stack overflow* |
| 12 | Software and control card ASIC incompatible* |
| 13 | Actual Model not same as stored in NV memory* |
| 14 | Unable to determine power stage* |
| 15 | Drive non-volatile parameters corrupt* |
| 16 | RAM failure* |
| 17 | Calibration RAM failure* |
| 18 | Encoder alignment: no motion fault |
| 19 | Encoder alignment: excessive motion fault |
| 20 | Encoder alignment: motor not settled |
| 21 | Encoder alignment: test failed |
| 22 | Encoder alignment: motion overflow fault |
| 23 | Hall Commutation: invalid configuration |
| 24 | Hall Commutation: overspeed |
| 25 | Hall Commutation: invalid hall state |
| 26 | Hall Commutation: invalid hall transition |
| 27 | I*t Drive |
| 28 | I^2*t Motor |

ExtFault (cont'd)

| ExtFault | ExtFault Description |
|-----------------|-----------------------------|
| 29 | DP RAM Test A * |
| 30 | DP RAM Test 5 * |
| 31 | DP RAM Test Run 1* |
| 32 | DP RAM Test Run 0 * |
| 33 | DP RAM Test C * |
| 65 | Data Read Only |
| 66 | Data Bounds Error |
| 67 | Execute no such command |
| 68 | RT not Implemented |
| 69 | FC not Implemented |

*These fault states CANNOT be reset with the Fault Reset function and require the line control power to be turned OFF and ON again.

6.1 Troubleshooting

Introduction A table of faults and their possible causes is listed below.

| FaultCode | Possible Cause |
|-----------|--|
| 1 | Loose or open circuit wiring to the resolver feedback connector J3. |
| | Actual motor speed exceeded $1.5 * (\text{Max Of } \text{VelLmtLo} \text{ or } \text{VelLmtHi})$ or 21,038 RPM which is the over speed trip level. |
| | For Encoder velocity feedback (RemoteFB = 2) check that EncIn is set properly. |
| 2 | Loose or open circuit wiring to motor PTC thermal sensor (J3-8, J3-9). |
| | High ambient temperature at motor. |
| | Insufficient motor heat sinking from motor mounting. |
| | Operating above the motor's continuous current rating. |
| 3 | Short circuited wiring on the output (J2-25). |
| 4 | Mechanically jammed motor. |
| | Motion profile accelerations too high. |
| | Machine load on the motor increased by a friction. |
| | Problem with wiring between drive and motor yielding improper motion. |
| | Drive and/or motor under sized for application. |
| | Note: See <i>HSTemp</i> , <i>ItFilt</i> , and <i>ItF0</i> for information on measuring thermal margin in an application. |

Fault Codes

| FaultCode | Possible Cause |
|-----------|--|
| 5 | Motor power wiring (TB1-4, 5, or 6) short circuit line-to-ground/neutral. |
| | Motor power cable length is enough longer than the data sheet specification to cause excessive motor line to earth ground/neutral capacitance. |
| | Internal motor winding short circuit. |
| | Insufficient motor inductance causing output over current faults. |
| | KIP or KII improperly set causing excessive output current overshoots. |
| 6 | Insufficient control AC voltage on TB1-1 to TB1-2. |
| | External short on signal connector. |
| | Internal drive failure. |
| 7 | Not Assigned. |
| 9 | Disconnected external regeneration resistor on TB1. |
| | External regeneration resistor ohmage too large yielding Bus OverVoltage fault. |
| | External regeneration resistor short circuit. |
| | Motor AC power input voltage too high. |
| 10 | Not Assigned. |
| 11 | Check the measured bus voltage VBus and the fault threshold VBusThresh to make sure they are consistent. |
| 12 | Ambient temperature is below drive specification. Drive's internal temperature sensor has a wiring problem. |
| 13 | Encoder Alignment failure. See ExtFault for additional information. |
| 14 | Not Assigned. |

Fault Codes

| FaultCode | Possible Cause |
|-----------|---|
| 15 | Attempt to upgrade the drive's software will not work. Contact factory for upgrade details. |
| | Resolver wiring error. Remove J2 and J3 connectors. Turn AC power OFF and then ON again. If FaultCode = 2, then correct resolver excitation wiring. |
| | Internal failure. Return to factory for repair. |
| | |
| 16 | Unconfigured drive (Red and Green LEDs blinking after power up) was fully configured with the drive motor power enable active. This fault can be reset or the control AC power turned OFF and then ON again to get the drive-motor operating. |
| 17 | The AInNull function was re-activated too soon after going inactive. This can be caused by switch bounce on the input pin mapped to activate AInNull. |
| 18 | The motor is either stalled or partially jammed. |
| | The value for PosErrorMax is set too sensitive for the loop tuning and commanded motion profiles. |
| 19 | Glitch while last saving the NV parameters. Corrupted NV memory contents. Hardware problem with the NV memory. Re-Download parameters to restore drive operation. |
| 20 | Initialization Failure. See ExtFault for additional information. |
| 21 | High drive ambient temperature. Restriction of cooling air due to insufficient space around unit. |
| | Operating above the drive's continuous current rating. |
| | Note: See <i>HSTemp</i> , <i>ItFilt</i> , and <i>ItF0</i> for information on measuring thermal margin in an application. |
| 22 | Resolver signal is lost or intermittent. Check resolver cable. |

6.2 Motor Commutation

IDN 32807 Number of motor magnetic poles (Polecount), which is the same as twice the number of motor electrical cycles per mechanical revolution. This IDN should be set so that:

For resolver based commutation (IDN 32853 = 0):

IDN 32807 (PoleCount) = Number of motor poles

For encoder based commutation (IDN 32853 = 1):

IDN 32807 (PoleCount) = Number of encoder counts / electrical cycle.

IDN 32807 = $4 * \text{IDN 32828} / (\text{Motor poles} / 2)$

Note: For encoder based commutation, it is required to do an encoder alignment using IDN 32854.

Example

If the application uses resolver based commutation with an R-Series motor, set IDN 32807 = 4 (R-Series motors have 4 poles).

If the application uses resolver based commutation with an S-Series motor, set IDN 32807 = 6 (S-Series motors have 6 poles).

If the application uses encoder based commutation with an R-Series motor and an 1024 line count encoder, set IDN 32807 = $4 * 1024 / (4/2) = 2048$.

Note: CommSrc (IDN 32853) must be set before PoleCount (IDN 32807).

IDN 32826 CommOff sets the origin for the electrical commutation angle. This IDN should be set so that for Pacific Scientific motors:

IDN 32826 (CommOff) = 0

6.3 System protection

Current Limits To protect the motor and drive, set the ILmts to:

IDN 82 Clockwise Current Limit (IlmtPlus). This IDN should be set so that:

$$\text{IlmtPlus} = \min(100\%, 100\% * 5 * I_{CS}/I_{\text{Peak}})$$

where I_{CS} is the motor's rms terminal current rating

IDN 82 = % of $I_{\text{Peak}} * 10$
(i.e. for a 9x3 IlmtPlus of 50% or 7.5A set IDN 82 to 500)

IDN 83 Counter-Clockwise Current Limit (IlmtMinus). This IDN should be set so that:

$$\text{IlmtMinus} = \min(100\%, 100\% * 5 * I_{CS}/I_{\text{Peak}})$$

where I_{CS} is the motor's rms terminal current rating

IDN 83 = % of $I_{\text{Peak}} * 10$
(i.e. for a 9x3 IlmtMinus of 50% or 7.5A set IDN 83 to 500)

Note: *Application requirements may constrain the ILmts even further.*

IDN 32829

ItThresh sets the maximum continuous output current, as a percentage of Ipeak, before the I*T thermal protection faults the drive. This IDN should be set so that:

$$\text{IDN 32829 (ItThresh)} = \min(60\%, 100\% * 3 * I_{\text{MTRcontinuous}} / I_{\text{PR}})$$

Ipeak

The following tables list the peak current rating for each of the drives in the PC800 family.

| Pacific Scientific Model | Ipeak (Amps) |
|--------------------------|--------------|
| 8X2 | 7.5 |
| 8X3 | 15.0 |
| 8X4 | 30.0 |

Appendix A Specifications

A.1 Output Power Specifications

| | <u>PC8x2</u> | <u>PC8x3</u> | <u>PC8x4</u> |
|--|---------------------|----------------------|----------------------|
| Peak Output Current (RMS)¹ | | | |
| 5 seconds, (0 to 40°C) Ambient | 5.3A _{RMS} | 10.6A _{RMS} | 21.2A _{RMS} |
| Continuous Output Current (RMS)² | | | |
| Convection (0 to 40°C) Ambient | 2.7A _{RMS} | 3.6A _{RMS} | 7.1A _{RMS} |
| Forced Air (0 to 40°C) Ambient ³ | N/A | 5.3A _{RMS} | 10.6A _{RMS} |
| Peak Output Power | | | |
| Idealized Electrical Max (rectangular torque vs. speed) | 2.25kW | 4.5kW | 9.0kW |
| Drive & Motor System Output Power | | | |
| 240 VAC three phase ⁴ (5 seconds) | 1.35 to 1.58kW | 2.7 to 3.15kW | 5.4 to 6.3kW |
| 240 VAC single phase (1 second) | 1.25 kW | 2.5 kW | 5.0 kW |
| 120 VAC single phase (1 second) | .63 kW | 1.25 kW | 2.5 kW |

- 1 To convert A_{RMS} to A (0-pk) multiply A_{RMS} * 1.41.
Peak current (5 sec): PC843 = 15A (0-pk), PC844 = 30A (0-pk)
- 2 Above 40°C ambient, linearly derate so that 50°C rating = 0.67*40°C rating.
- 3 Forced air requires 3.6" x 1" fan mounted 2" below the drive.
- 4 Varies with the motor. Maximum peak output power with most motors is between 60% to 70% of Idealized Electrical Max.

A.1 Output Power Specifications (Cont'd)

| | <u>PC8x2</u> | <u>PC8x3</u> | <u>PC8x4</u> |
|---|--------------|--------------|--------------|
| Continuous Output Power Drive & Motor System @ Convection Ambient | | | |
| 240 VAC three phase | 1.1kW | 1.5kW | 3.0kW |
| 240 VAC single phase | 1.1kW | 1.5kW | 2.0kW* |
| 120 VAC single phase | 550W | 750W | 1.0kW* |
| RMS Line Current @ Continuous Output Power Convection Ambient | | | |
| 240 VAC three phase | 4.5 A | 6 A | 12 A |
| 240 VAC single phase | 9 A | 12 A | 16 A* |
| 120 VAC single phase | 9 A | 12 A | 16 A* |
| *Single phase operation of the PC8x4 requires derating of continuous output power to avoid excessive line and front end currents. | | | |
| Power Stage Efficiency @ P_{cont} | 98% | 98% | 98% |
| Shunt Regulator Power | | | |
| Peak Power (500 mSec) | 12.8kW | 12.8kW | 12.8kW |
| Continuous Power** | 800W | 800W | 800W |
| Maximum External Regen Duty Cycle | 6% | 6% | 6% |
| Bus Capacitance Energy Absorption | | | |
| From 320V Nominal Bus | 20J | 30J | 40J |

**See Appendix E, *Using External Regen* for additional information.

A.1 Output Power Specifications (Cont'd)

| | <u>PC8x2</u> | <u>PC8x3</u> | <u>PC8x4</u> |
|--|----------------------|--------------|--------------|
| Output Current Ripple Freq f_s | 20 kHz | 20 kHz | 16 kHz |
| Minimum Motor Inductance I-I | 4.0mH | 2.0mH | 1.25mH |
| Maximum Motor Inductance I-I | 4H | 2H | 1H |
| Maximum Motor Power Cable Length | -----50 m/164ft----- | | |

A.2 Input Power Specifications

The drive is capable of direct line operation. All units are fully isolated and do not require external isolation transformers. Also, the inrush current on the connection to the line is internally limited to a safe level for the drive. There are no voltage selection or ranging switches required to operate within the specified voltage input ranges. It is the responsibility of the user to supply appropriate fuses or circuit breakers in the TB1 AC Power motor power lines to comply with local electrical codes.

The control input power required should be between 15 and 25 Watt. The AC input motor power depends on output power and the losses in the power stage. The control power input has a single UL/CSA rated fuse in line with one of the AC line inputs.

PC800 Control Power Supply

Input Voltage Range

85 to 265 VAC,
47 - 440 Hz single phase or 130 to 370 Vdc

Ride Through Time
For AC Line Drop

90 VAC 50 Hz >0.7 50 Hz cycle
120 VAC 60 Hz >2.1 60 Hz cycles
240 VAC 60 Hz >13.3 60 Hz cycles

PC830 Motor AC Power Supply

| Model Number | Voltage Range | Phases | Transformer Suggested kVA | Maximum AC Line* kVA |
|--------------|---------------|--------|---------------------------|----------------------|
| PC8x2 | 90-265 Vac | 1 or 3 | 1.5 to 3 kVA | 100 kVA |
| PC8x3 | 90-265 Vac | 1 or 3 | 2 to 4 kVA | 100 kVA |
| PC8x4 | 180-265 Vac | 3 | 3 to 6 kVA | 250 kVA |

*Maximum AC Line is specified to limit the line surges coupled to the drive.

Bus Voltage (nominal, standard drive)

240 VAC Three Phase Input 320 VDC

120 VAC Single Phase Input . . . 155 VDC

PC840 Inrush Current & Fusing

| Model Number | Inrush Peak Current | Inrush Pulse Width | Fuse Type | Manufacturer, Part Number |
|--------------|---------------------|--------------------|-----------------------|---------------------------|
| PC8x2 | 300 A 0-p | 1.0 msec | 10 A 250 V Time Delay | Bussmann, MDA-10 |
| PC8x3 | 300 A 0-p | 1.5 msec | 20 A 250 V Time Delay | Bussmann, MDA-20 |
| PC8x4 | 300 A 0-p | 2.0 msec | 30 A 250 V Slo-Blo | Littlefuse, FLM 30 |

A.3 Performance Characteristics

Note: Unless otherwise specified, the below specifications are worst case limits and apply over the specified operating ambient temperature and over the specified operating line voltage.

Motor Current Control

| | |
|--|---|
| Motor Phase Current Waveform | Back EMF Matched Pseudo Sine |
| Motor Shaft Torque (Ignoring motor magnetic saturation) | |
| Peak (hot) ⁵ | $K_t \text{ (Nm/A}_{\text{RMS}}) * \text{Drive I}_{\text{peak}}$ (A_{RMS}) |
| Instantaneous | $K_t \text{ (Nm/A}_{\text{RMS}}) * \text{IFB} / \sqrt{2}$ |
| Bandwidth | |
| Maximum Bandwidth | 1.5 kHz |
| Recommended Bandwidth | 1.0 kHz |
| Bandwidth Variation For Fixed Motor L | $\pm 10\%$ |
| Bandwidth Variation For $\pm 25\%$ | |
| AC Line Variation | $\pm 2\%$ |
| Update Period | 62.5 μsec |
| Recommended Motor Electrical Frequency | < 400 Hz |

5 Multiply by 1.06 for cold K_t (PMA motors).

Analog Command

| | |
|----------------------------------|---|
| Maximum Differential Range | ± 13.5 Volts |
| Maximum Single Ended Range | ± 21 Volts |
| Full Scale Tolerance | $\pm 5\%$ (worst case) $\pm 1\%$ (typical) |
| Linearity | 0.1% Full Scale |
| Monotonic to | $< 2^{-16}$ Full Scale |
| S/N Ratio Referred to Full Scale | |
| Full A/D Bandwidth | 14 bits |
| 150 Hz A/D Bandwidth | 16 bits |
| 10 Hz A/D Bandwidth | 18 bits |
| Offset | Adjustable to 0 |
| Maximum Unadjusted Offset | 50 mV |
| Offset Drift | 250 $\mu\text{V}/^\circ\text{C}$ typ. |
| CMRR | > 30 dB @ 60 Hz |

Digital Position Commands

| | |
|--------------------------------------|--|
| Modes | Quadrature Encoder, Step & Direction, or Up & Dn Count |
| Maximum Input Rate For Fast Decode | |
| Quadrature Decode Max Line Frequency | 800 kHz |
| Step/Dir Decode Max Step Frequency | 800 kHz |
| Up/Dn Count Max Frequency | 800 kHz |
| Minimum Fast Decode Pulse Width | 0.6 μSec |
| Fast Decode Direction Setup Time | 0.6 μSec |
| Fast Decode Direction Hold Time | 0.6 μSec |
| Relative Timing For Filtered Decode | 4, 8, or 16 to 1 e.g. Max Step Freq 800, 200, 100, or 50 kHz |

Velocity Loop

| | |
|---|---|
| Maximum Stable Bandwidth | > 400 Hz |
| Update Period | 250 μ Sec |
| Range | 0 to 21,000 RPM |
| Command Resolution | < 0.001 RPM |
| Velocity Loop Compensation Parameters | |
| KVP Range (Depends on I _{peak}) | 0 to 12.6 (I _{peak})(1/rad/sec) |
| KVP Resolution | 16 bit |
| KVI Range | 0 to > 200 Hz |
| KVI Resolution | 16 bit |
| ARF0* Range | 0.01 to > 1e5 Hz |
| ARF1* Range | 0.01 to > 1e5 Hz |
| ARZ0* Range | 0 to > 1e5 Hz or off |
| ARZ1* Range | 20 to > 1e5 Hz or off |
| CMDGAIN Range | 0 to $\pm 15,000$ RPM/V |
| | 0 to $\pm 10(I_{\text{peak}}) V^{-1}$ |
| CMDGAIN Resolution | ≥ 16 bit mantissa |

*ARx0 set to a negative number allows complex poles/zeros. In this case, ARx1 becomes the Q and the corresponding |ARx0| is the frequency in Hz.

Position Loop

| | |
|---------------------------------------|------------------------------|
| Maximum Stable Bandwidth | > 100 Hz |
| Update Period | 1 mSec |
| Position Range | 0 to ± 32768 Rev |
| Position Error Range | 0 to ± 4500 Rev |
| Command Resolution | 2^{-16} Rev = 0.33 arc min |
| Position Loop Compensation Parameters | |
| KPP Range | 0 Hz to > 150 Hz |
| KPP Resolution | 16 bit |
| KVFF Range | 0 to 199.9% |
| KVFF Resolution | 16 bit |

General

| | |
|--|---------|
| Max Delay AC Line To Control Supply On | 1.0 Sec |
| Max Delay AC Line To Fully Operational | 2.0 Sec |

Environmental

| | |
|--------------------------|--------------------|
| Storage Temperature | -40°C to 70°C |
| Humidity, non-condensing | 10% to 90% |
| Altitude | 1500 m (5000 feet) |

A.4 Resolver Feedback Specifications

Note: *Unless otherwise specified, the below specifications are worst case limits and apply over the specified operating ambient temperature and over the specified operating line voltage.*

Resolver Position Signal

| | |
|--------------------------------|--|
| Resolution/Rev | 24 bits = 0.0013 arc min |
| Repeatability | $< \pm 2^{-18}$ Rev = ± 0.08 arc min rms |
| Noise | |
| No Filtering | $< 2^{-16}$ Rev rms = 0.3 arc min rms |
| 150 Hz Single Pole Filtered | $< 2^{-17}$ Rev rms = 0.16 arc min rms |
| 10 Hz Single Pole Filtered | $< 2^{-19}$ Rev rms = 0.04 arc min rms |
| dc Offset Temperature Drift | $< 2^{-18}$ Rev/ $^{\circ}$ C = 0.08 arc min/ $^{\circ}$ C |
| Absolute Accuracy | |
| Drive only | $\pm 2^{-12}$ Rev = ± 5.3 arc min |
| Drive with 20 arc min resolver | $\pm 2^{-9.75}$ Rev = ± 25 arc min |
| Software Update Time | 1 mSec |

Resolver Velocity Signal

| | |
|--------------------------------|-----------------------|
| Resolution | < 0.001 RPM |
| Quanta | = 0.0143 RPM |
| Noise | |
| No Filtering | < 3 RPM rms |
| 150 Hz Single Pole Filtered | < 0.6 RPM rms |
| 10 Hz Single Pole Filtered | < 0.06 RPM rms |
| DC Accuracy | |
| Typical @ 25°C | ±0.01% |
| Worst case | ±0.05% |
| Ripple | |
| Drive only | 0.75% p-p at 1000 RPM |
| Drive with 20 arc min resolver | 3% p-p at 1000 RPM |
| Offset | < 0.0001 RPM |
| Software Update Time | 250 μ Sec |

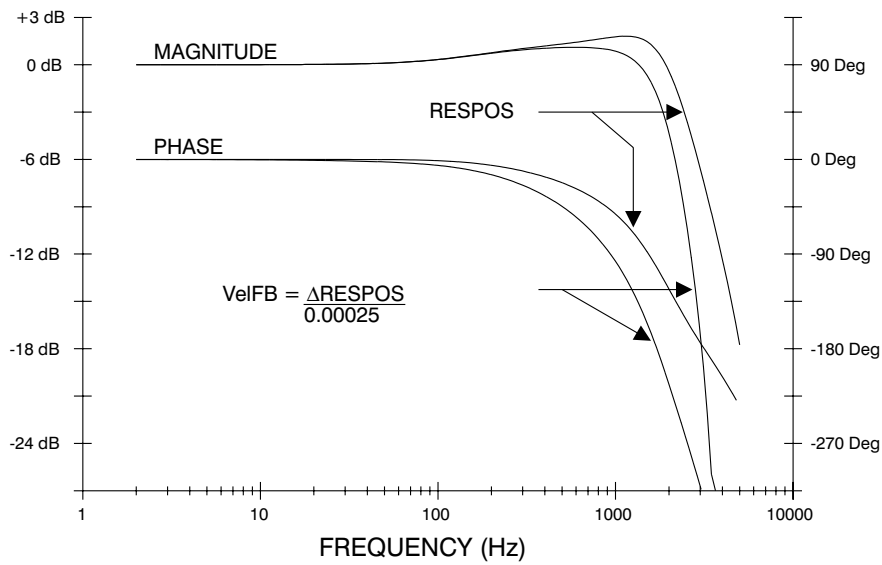
Emulated Encoder Output Signals

| | |
|-----------------------------------|---|
| Available Resolutions (PPR) | |
| Binary | 128, 256, 512, 1024, 2048, 4096, 8192, 16384 |
| Decimal | 125, 250, 500, 1000, 2000, 4000, 8000, 16000 |
| Maximum Output Line Frequency | 833 kHz |
| Max Recommended Speed @ 16384 PPR | 2900 RPM |
| Max Recommended Speed @ 4096 PPR | 11600 RPM |
| Marker Pulse Width | ≈ 1 Quadrature Pulse |

General

| | |
|-------------------------------|----------------------------|
| -3 dB Bandwidth | > 1500 Hz |
| -45° Phase Lag | > 400 Hz |
| Resolver Excitation Frequency | 6510.42 Hz |
| Max Tracking Rate | > 48600 RPM |
| Max Recommended Rate | 25 kRPM |
| Max Tracking Acceleration | > 16×10^6 RPM/Sec |
| Maximum Feedback Cable Length | 50 m/164 ft |

Nominal Frequency Response



The PC830 packaging is totally enclosed single axis panel mount. The figure on the next page gives the key dimensions for use in physically mounting the product. When mounting multiple units on one panel there should be at least 20 mm (0.75") of air space on the sides and 40 mm (1.5") or air space above and below the unit.

When mounting multiple drives in a row some customers have found the stiffness of the drive and their mounting panel to be too low. To increase the mounted mechanical integrity, connect to the threaded insert on the top front edge.

The overall drive panel dimensions and the mounted depth not including mating connectors is listed in the below chart. The extra depth for mating connectors is 1.0" or less.

Dimensions

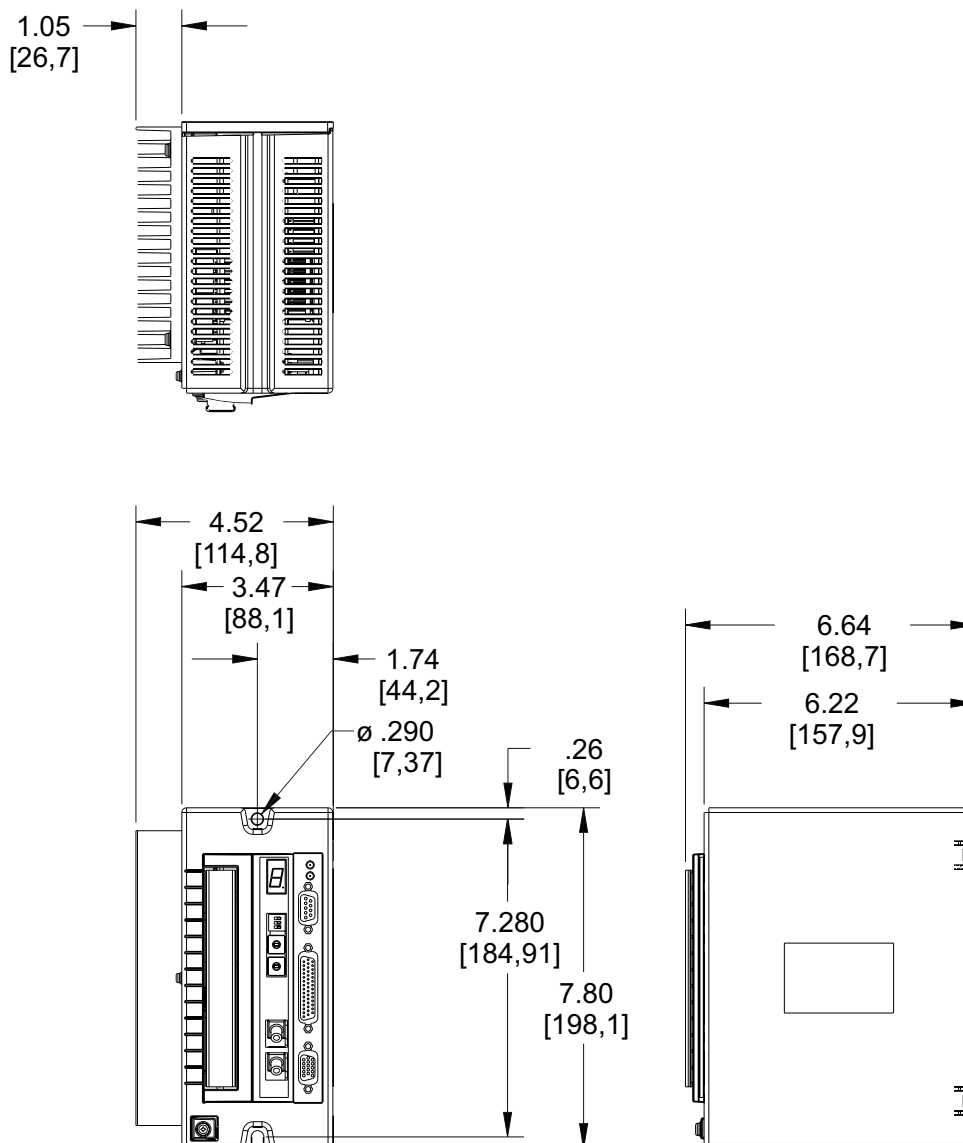
| Model | Height | Width | Depth |
|-------|---------------|---------------|--------------|
| PC8x2 | 198.1 mm/7.8" | 88.1 mm/3.47" | 158 mm/6.22" |
| PC8x3 | 198.1 mm/7.8" | 88.1 mm/3.47" | 158 mm/6.22" |
| PC8x4 | 198.1 mm/7.8" | 114 mm/4.49" | 158 mm/6.22" |

Weight

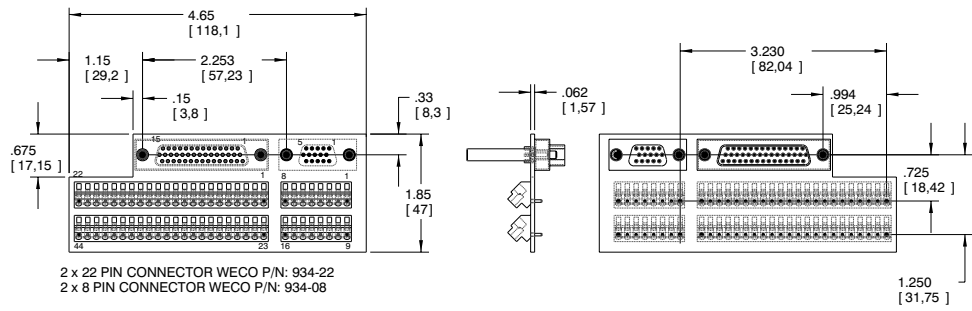
| Model | Weight |
|-------|---------------|
| PC8x2 | 1.9 kg/4 lb |
| PC8x3 | 2 kg/4.3 lb |
| PC8x4 | 2.6 kg/5.7 lb |

Drive Mechanical Outline

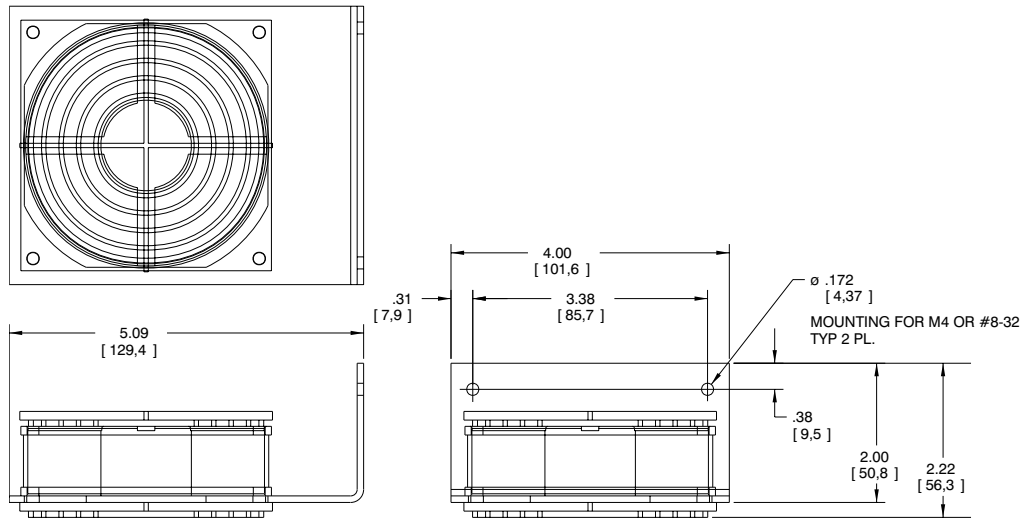
PC8X2/3/4



PC830 Terminal Block Adapter



Fan Option Kit



Appendix B Model Identification

B.1 Servo Drive Package Order Numbering System

P C 8 X X - 0 0 1 - X

PC8 = Servo Drive Family Designation

4 = Command Interface Designation

4 = SERCOS Network

3 = Power Level

2 = 2.7 A_{RMS} cont. @ 25 °C, 5.3 A_{RMS} pk.

3 = 3.6 A_{RMS} cont. @ 25 °C, 10.6 A_{RMS} pk.

4 = 7.1 A_{RMS} cont. @ 25 °C, 21.2 A_{RMS} pk.

- 001 = Customization Code

001 = Standard Unit

XYZ = Factory Assigned Hardware Customization

X = Accessories

N = No accessories

A = Basic connector kit

T = TB adapter connector kit

Example Order Numbers

| Order # | Model # | Description |
|-------------|-------------|---|
| PC843-001-T | PC843-001-T | 10.6 A _{RMS} peak standard servo drive |
| | CA800-TB | TB adapter PC803 connector kit |
| | MA840 | <i>PC840 User Manual</i> |
| PC844-001-A | PC844-001-A | 21.2 A _{RMS} peak standard servo drive |
| | CA800 | Basic PC804 connector kit |
| | MA840 | <i>PC840 User Manual</i> |
| PC844-001-N | PC844-001-N | 21.2 A _{RMS} peak standard servo drive |
| | MA840 | <i>PC840 User Manual</i> |

B.2 PC800 Accessories

Connector Mate Kits

CA800 15-pin and 44-pin d-subminiature mates for the PC80x servo drive.

CA800-TB 15-pin and 44-pin d-subminiature terminal block adapter mates for the PC80x servo drive.

Manual and Documentation Kits

MA840 *PC840 User Manual*

Regen Resistors

PRK-200 External regen resistor kit

Fan Kits

PFK-120 120 VAC Fan

PFK-240 240 VAC Fan