HARDWARE REFERENCE MANUAL

Turbo PMAC2 Realtime Express Controller

Programmable Multi-Axis Controller

9xx-603862-1xx

October 14, 2013

DELTA TAU
Data Systems, Inc.
NEW IDEAS IN MOTION ...

Single Source Machine Control *Power // Flexibility // Ease of Use*
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Operating Conditions

All Delta Tau Data Systems, Inc. motion controller products, accessories, and amplifiers contain static sensitive components that can be damaged by incorrect handling. When installing or handling Delta Tau Data Systems, Inc. products, avoid contact with highly insulated materials. Only qualified personnel should be allowed to handle this equipment. In the case of industrial applications, we expect our products to be protected from hazardous or conductive materials and/or environments that could cause harm to the controller by damaging components or causing electrical shorts. When our products are used in an industrial environment, install them into an industrial electrical cabinet or industrial PC to protect them from excessive or corrosive moisture, abnormal ambient temperatures, and conductive materials.
If Delta Tau Data Systems, Inc. products are exposed to hazardous or conductive materials and/or environments, we cannot guarantee their operation.

REVISION HISTORY				
REV.	**DESCRIPTION**	**DATE**	**CHG**	**APPVD**
1	NEW MANUAL CREATION	04/03/07	CP	S. SATTARI
2	CLEARED FOR RELEASE	12/07/07	CP	S.SATTARI
3	REVISED GENERAL PURPOSE IO CONNECTOR ADDED MULTIPLEXED IO PORT INFO ADDED PANASONIC PROGRAM SETUP INFO ADDED PARAMETER PASSING INFO ON REALTIME EXPRESS NETWORK	01/29/09	CP	S.SATTARI
4	CORRECTION IN J5 PIN-OUT TABLE UPDATED WIRING FOR HANDWHEEL PORT IMAGE	02/15/10	CP	S.SATTARI
5	ADDED SUPPORT FOR A5N NETWORK DRIVES	10/14/13	SS	S.SATTARI

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INTRODUCTION

Overview

The Turbo PMAC2 Realtime Express Controller is a member of the Turbo PMAC family of boards optimized for interface to the system through Panasonic's Realtime Express Network. It can command up to 32 axes through Realtime Express Network. This controller is also capable of communicating and control of MACRO drives and IO modules if ordered with the MACRO option.

The Turbo PMAC2 Realtime Express Controller is a stand-alone unit which can be communicated with via RS-232, USB or Ethernet connections, with or without the optional dual-ported RAM.

This controller is also capable of Fieldbus communications when the appropriate option is ordered. The form factor of this connection is dependent on which Fieldbus protocol is being utilized and it supports the following protocols:

- ProfiBus Master Opt-1
- ProfiBus Slave Opt-2
- DeviceNet Master Opt-3
- DeviceNet Slave Opt-4
- CANopen Master Opt-5
- CANopen Slave Opt-6
- CC-Link Slave Opt-11

The protocol is dependent upon which hardware and option are selected. The hardware cannot be programmed for an alternate protocol including master/slave.

Compatibility

This controller can be used to control Panasonic A4N/A5N Drives over the Realtime Express network. This network utilizes the Ethernet type CAT-5 cable as the communication medium, but should not be connected to any other Ethernet network.

Note

Currently, the controller only supports single block slave nodes.

If ordered with the MACRO option, this controller can control MACRO drives and I/O devices over either the fiber optic MACRO ring or copper MACRO ring.

Configuration

Base Version

The base version of the Turbo PMAC2 Realtime Express Controller provides:

- 80 MHz DSP56303 CPU
- 128k x 24 SRAM compiled/assembled program memory
- 128k x 24 SRAM user data memory
- 1M x 8 flash memory for user backup & firmware
- 32k x 16 bank of dual-ported RAM
- Latest released firmware version
- RS-232 serial interface, USB 2.0 & Ethernet Communication
- (No on-board axis interface circuitry)
- Two channels supplemental interface circuitry, each including:
    - 2-channel differential/single-ended encoder input
    - One output command signal set, configurable as pulse-and-direction or PWM top-and-bottom pair
- Direct I/O interface port
- 1-year warranty from date of shipment

(Cables not included)

Macro Ring Connector Options

If a MACRO interface is desired (which is the usual reason for use of the board), at least one of the MACRO connector options must be selected.

• **Option A** provides the MACRO-ring fiber optic SC-style interface connector. The key component on the board is U49.

• **Option C** provides the MACRO-ring RJ-45 electrical interface connectors. The key components on the board are CN3 and CN4.

Option 1: Additional MACRO Interface ICs

• **Option 1A** provides the first additional MACRO interface IC (2 total) for 16 additional MACRO nodes, eight additional servo nodes and eight additional I/O nodes (32 nodes total, 16 servo and 16 I/O). The key component on the board is U41.

• **Option 1B** provides the second additional MACRO interface IC (3 total) for 16 additional MACRO nodes, eight additional servo nodes and eight additional I/O nodes (48 nodes total, 24 servo and 24 I/O). The key component on the board is U42. Option 1A is a pre-requisite.

• **Option 1C** provides the third additional MACRO interface IC (4 total) for 16 additional MACRO nodes, eight additional servo nodes and 8 additional I/O nodes (64 nodes total, 32 servo and 32 I/O). The key component on the board is U43. Options 1A and 1B are pre-requisites.

Option 5: CPU and Memory Configurations

Different versions of Option 5 provide different CPU speeds and main memory sizes. Only one Option 5xx may be selected for the board. The CPU is a DSP563xx IC as component U1. The CPU is available in two speed options: 80MHz CPU is a DSP56303 (Option 5C0), 240 MHz CPU is a DSP56321 (Option 5F3). The Maximum frequency of operation is indicated with a sticker on the CPU in U1.

The compiled/assembled-program memory SRAM ICs are located in U30, U31, and U32. These ICs form the active memory for the firmware, compiled PLCs, and user-written phase/servo algorithms. These can be 128k x 8 ICs (for a 128k x 24 bank), fitting in the smaller footprint, or they can be the larger 512k x 8 ICs (for a 512k x 24 bank), fitting in the full footprint. The user-data memory SRAM ICs are located in U27, U28, and U29. These ICs form the active memory for user motion programs, uncompiled PLC programs, and user tables and buffers. These can be 128k x 8 ICs (for a 128k x 24 bank), fitting in the smaller footprint, or they can be the larger 512k x 8 ICs (for a 512k x 24 bank), fitting in the full footprint.
The flash memory IC is located in U26. This IC forms the non-volatile memory for the board's firmware, the user setup variables, and for user programs, tables, and buffers. It can be 1M x 8, 2M x 8, or 4M x 8 in capacity.

- **Option 5C0**: Default CPU speed and memory configuration: 80MHz DSP56303 CPU (8Kx24 internal memory), 128Kx24 SRAM compiled/assembled program memory, 128Kx24 SRAM user data memory, 1Mx8 flash memory.

- **Option 5C3**: Default CPU speed and memory configuration: 80MHz DSP56303 CPU (8Kx24 internal memory), expanded 512Kx24 SRAM compiled/assembled program memory, expanded 512Kx24 SRAM user data memory, 4Mx8 flash memory.

- **Option 5F3**: 240MHz DSP56321 CPU (192Kx24 internal memory), expanded 512Kx24 SRAM compiled/assembled program memory, expanded 512Kx24 SRAM user data memory, 4Mx8 flash memory.

Option 10: Firmware Version Specification

Normally the Turbo PMAC2 Eth Ultralite is provided with the newest released firmware version. The response to the VERSION query command shows which firmware revision is presently installed. Option 10 provides for a user-specified firmware version.

Option 12: Analog-to-Digital and Digital-to-Analog Converters

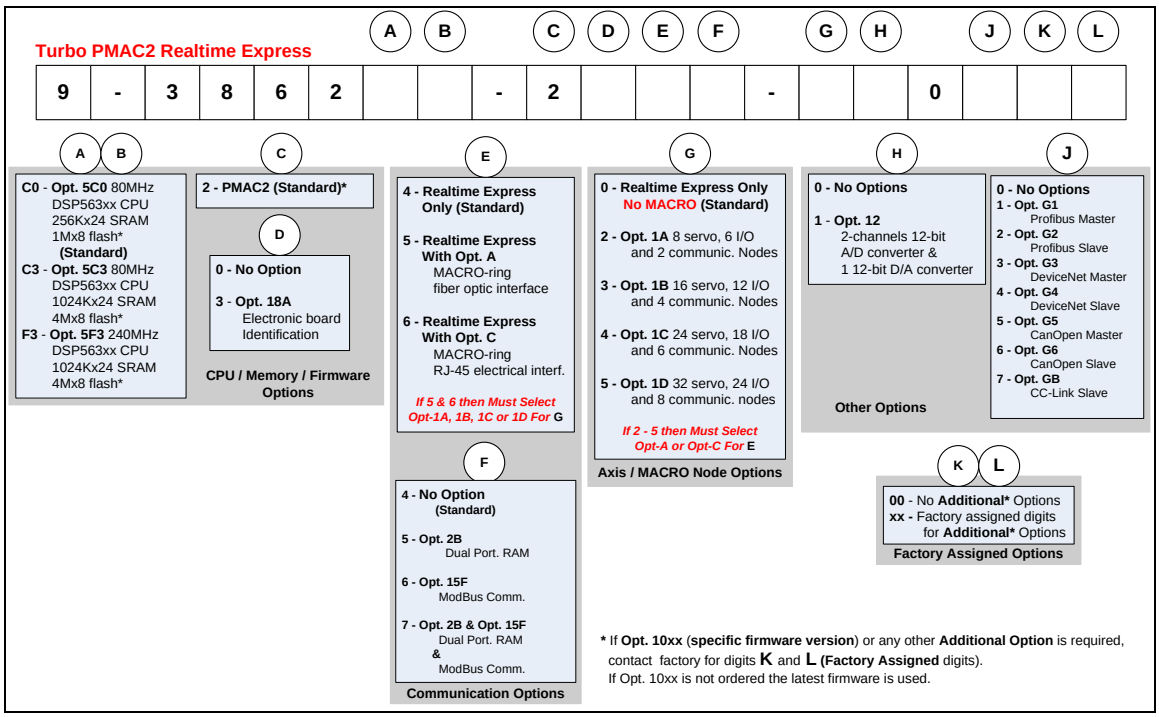
Option 12 permits the installation of two channels of on-board analog-to-digital converters and one channel of on-board digital-to-analog converter.

The analog inputs are not optically isolated, and each can have a +/- 10V input range, or a +/-5V input range if differential signal is used, individually selectable with a 12-bit resolution.

The analog output is a 12-bit DAC have +/-10V output range.

Part Number Definition

Based on the different options of Turbo PMAC 2 Realtime Express Controller, there will be a single line part number which is used for ordering and identification. The part number is assigned based on the following chart:



For detailed information on any of these options, please refer to the previous section of this manual.

HARDWARE SETUP

Receiving and Unpacking

Delta Tau products are thoroughly tested at the factory and carefully packaged for shipment. When the Turbo PMAC2 Realtime Express Controller is received, do the following immediately.

1. Inspect the condition of the shipping container and report any damage immediately to the commercial carrier that delivered the controller.
2. Remove the controller from the shipping container and remove all packing materials. Check all shipping material for connector kits, documentation, diskettes, CD ROM, or other small pieces of equipment. Be aware that some connector kits and other equipment pieces may be quite small and can be accidentally discarded if care is not used when unpacking the equipment. The container and packing materials may be retained for future shipment.
3. Verify that the part number of the controller received is the same as the part number listed on the purchase order.
4. Inspect the controller for external physical damage that may have been sustained during shipment and report any damage immediately to the commercial carrier that delivered the controller.
5. Electronic components in this controller are design-hardened to reduce static sensitivity. However, use proper procedures when handling the equipment.
6. If the controller is to be stored for several weeks before use, be sure it is stored in a location conforming to published storage humidity and temperature specifications stated in this manual.

Mounting

The location of the control is important. Installation should be in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and other contaminants. Exposure to these can reduce the operating life and degrade performance of the control.

Several other factors should be evaluated carefully when selecting a location for installation:

- For effective cooling and maintenance, the control should be mounted on a smooth, non-flammable vertical surface.
- At least 3 inches (76mm) top and bottom clearance must be provided for airflow. At least 0.4 inches (10mm) clearance is required between controls (each side).
- Temperature, humidity and Vibration specifications should also be taken in account.

The Turbo PMAC2 Realtime Express Controller can be mounted with a traditional 2-hole panel mount, one U-shape/notch on the bottom and one pear-shaped hole on top.

The controller is mounted to a back panel. The back panel should be unpainted and electrically conductive to allow for reduced electrical noise interference. The back panel should be machined to accept the mounting bolt pattern of the controller. Make sure that all metal chips are cleaned up before the controller is mounted so there is no risk of getting metal chips inside the controller.

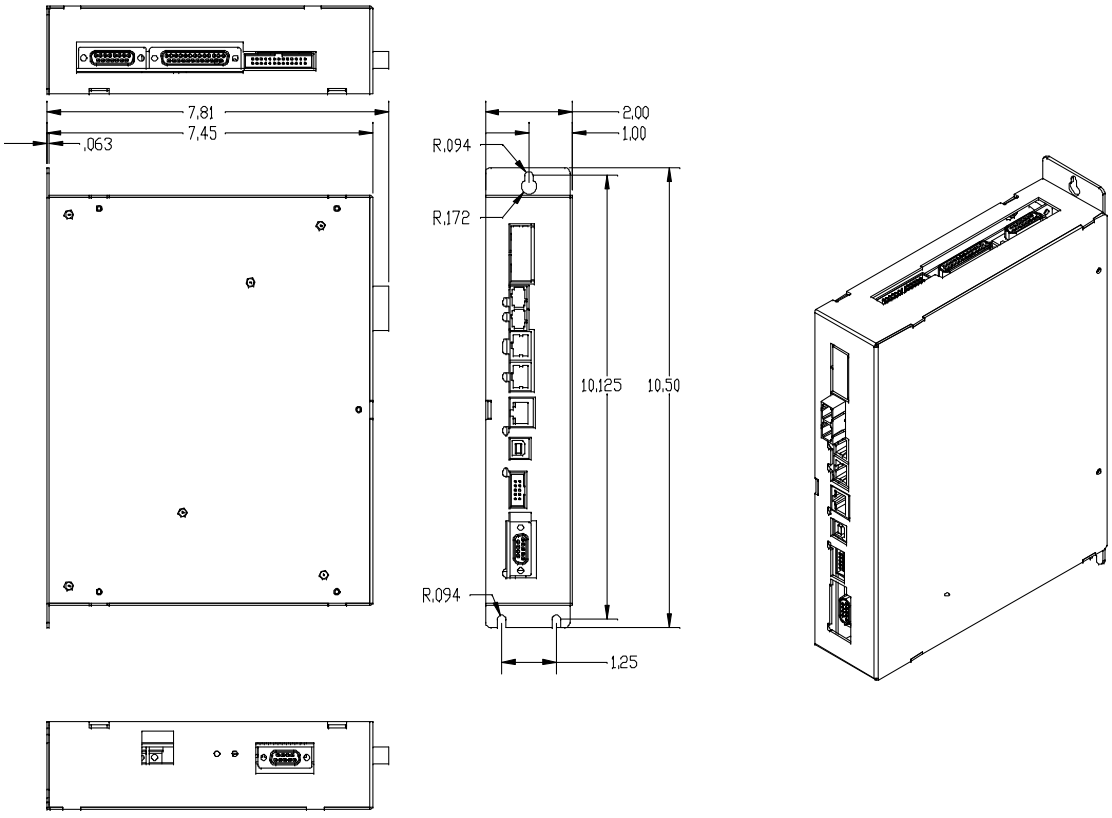
The controller is mounted to the back panel with four M4 screws and internal-tooth lock washers. It is important that the teeth break through any anodization on the controller's mounting gears to provide a good electrically conductive path in as many places as possible. Mount the controller on the back panel so there is airflow at both the top and bottom areas of the controller (at least three inches).

Caution:

Units must be installed in an enclosure that meets the environmental IP rating of the end product (ventilation or cooling may be necessary to prevent enclosure ambient from exceeding 45° C [113° F]).

Mechanical Drawing

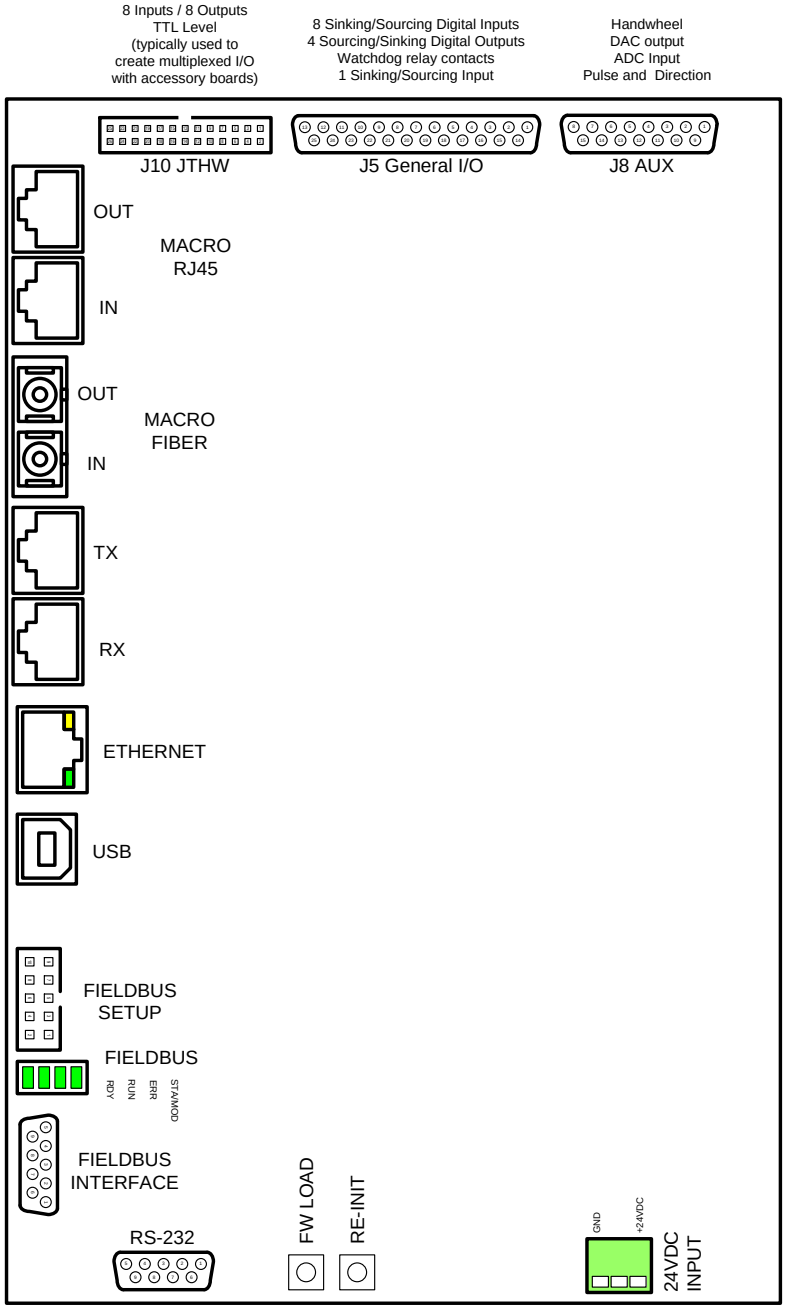
The figures below show the mounting dimensions of the controller.



Note:

For more detailed drawings (SolidWorks, eDrawings, DXF), visit our website at http://www.deltatau.com.

System Wiring



MACRO

Motion And Control Ring Optical

The Light Link in Motion ...

The Macro Connector will be used to form a ring between all the MACRO components of the system.

For RJ-45 connector, standard CAT-5 or CAT-6 cables with standard RJ-45 connection can be used to form the ring.

For FIBER option, fiber cable with SC-style connectors is used as communication medium between the MACRO stations

Panasonic

The TX and RX connectors get connected to A4N/A5N Drives from Panasonic.

Ethernet connection can be used either for communication between the unit and a PC as user interface or with MODBUS option it can be configured as MODBUS MASTER or SLAVE for expanding the control solution.

USB connection can be used either for communication between the unit and a PC as user interface.

FIELDBUS connector gets connected directly to the Hilscher module inside the unit and the SyCon software for setting up the module

The FIELDBUS connector is the main connector between the Hilscher module and the optional FieldBus network. Please check the pin out configuration section carefully.

Serial Connection (RS-232) can be used to talk to the CPU directly. Since the parser on this port can be turned off, it can also be used for communicating to the 3rd party devices over RS-232

By holding FW LOAD micro-switch while power-up, you can place the card in Bootstrap mode for loading firmware

By holding RE-INIT micro-switch while power-up, the card will load the factory default settings instead of saved settings on FLASH

24VDC
0.75 A continues
1.8 A start up

Push-button Switches

There are two push-button switches located at the bottom of the unit next to the 24V power supply input. These buttons are accessible for reinitializing the board back to factory default settings and loading new firmware revisions.

FW LOAD switch

The FW LOAD switch is used to download new firmware to the controller. In order to use this switch, you need to hold the switch pressed while powering up the system. This will cause the system to go to bootstrap mode, after which you can use Delta Tau's Executive software to download the new firmware to the controller.

RE-INIT switch

The RE-INIT switch will cause the controller to reset to factory default settings. To use this function, you need to hold down the switch while powering up the system. This will stop the controller to load your settings from the EEPROM and load factory default settings instead. Although your settings is not loaded once you power up holding the RE-INIT switch, your settings are still available in the EEPROM, until you overwrite them with a SAVE command.

Caution:

Loading the factory default settings for this specific controller will stop the normal functioning of the system over the MACRO and/or Realtime Express Ring. To get the controller to communicate over the ring, you need to download the backup settings file available from Delta Tau's website at http://www.deltatau.com.

Connections

USB Connection, J1

This connector is used in conjunction with USB A-B cable, which can be purchased from any computer store. The A connector is connected to a PC or hub device and the B connector plugs into the J1-USB port. USB drivers are always included in the latest software packages from Delta Tau's website at http://www.deltatau.com.

Note:

Since the USB connector will connect the ground on the controller and computer together, make sure that computer and the controller have the same voltage ground, i.e., that they are connected to the same power line.

Pin #	Symbol	Function
1	VCC	N.C.
2	D-	DATA-
3	D+	DATA+
4	GND	Ground
5	SHELL	Shield
6	SHELL	Shield

Ethernet / Modbus Connection, J2

This connector is used for Ethernet communications from the Turbo PMAC2 Eth Ultralite to a PC or into an Ethernet network. The default IP address for all Delta Tau products with Ethernet communication capability is 192.6.94.5 which can be changed later with the proper software provided by Delta Tau.

This port can support Modbus communication and can act as either Server or Client on a Modbus Network. There are four sockets available on this port and each of them can be configured as Modbus Server/ Modbus Client / PMAC ASCII or PMAC INTR. If you want to use this port for communication purposes with the controller, you need to set at least one of the sockets to PMAC ASCII.

Note:

Delta Tau Systems strongly recommends the use of RJ45 CAT5e or better shielded cable.

Newer network cards have the Auto-MDIX feature that eliminates the need for crossover cabling by performing an internal crossover when a straight cable is detected during the auto-negotiation process.

For older network cards, one end of the link must perform media dependent interface (MDI) crossover (MDIX), so that the transmitter on one end of the data link is connected to the receiver on the other end of the data link (a crossover/patch cable is typically used). If an RJ45 hub is used, then a regular straight cable must be implemented.

Maximum length for Ethernet cable should not exceed 100m (330ft).

J2 **RJ-45 Female Connector**		 1
Pin #	**Symbol**	**Function**
1	TX+	Transmit line
2	TX-	Transmit line
3	Unused	
4	Unused	
5	Unused	
6	Unused	
7	RX +	Receive line
8	RX -	Receive line
Amber LED	Activity	Blinking indicates transmit/receive activity
Green LED	Link	Solid Green indicates a valid connection

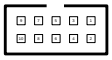
Fieldbus Setup Connector, J3

This connector is a 10-pin female flat cable connector that is directly connected to the Fieldbus communication device installed in the system based on order options. Use SyCon program to set up the communication module. SyCon is a universal Fieldbus configuration tool developed by Hilscher Corporation used to configure the PMAC Gateway. Delta Tau has licensed SyConas part of the PMAC Gateway product. The Hilscher license agreement, which will be presented during the installation process, still applies.

Besides being able to configure Fieldbus systems like ProfiBus, DeviceNet, CANopen, and ControlNET, SyCon can also configure Interbus, SDS, etc. The usefulness is that SyCon becomes a common tool providing consistent user interface for all protocols for both masters and slaves.

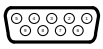
SyCon checks the dependencies between the devices, checks for configuration conflicts and warns of possible errors. Some protocols support standardized files containing information about all features and limitations of the slave device. SyCon uses these files for the configuration.

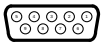
After the configuration, switch SyCon into a diagnostic mode. In diagnostic mode, you can monitor status information of all devices connected to the network. For example, the node list or slave diagnostic information can be monitored. If a slave is not operating correctly, it will be displayed in a different color, normally red. The base address for master modules is located at memory location $6D000 and for slave modules at $6D700.

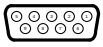
J3 **10- pin Male Flat ribbon header connector (IDC)**		
Pin #	**Symbol**	**Function**
1	N.A.	N.C.
2	HilDTR	Data terminal ready (DTR)
3	HilTxD-	Transmit Data (TXD)
4	HilCTS	Clear to Send (CTS)
5	HilRxD-	Receive Data (RXD)
6	HilRTS	Request to Send (RTS)
7	HilDSR	Data Set Ready (DSR)
8	N.A.	N.C.
9	GND	Signal Ground
10	+5V	+5 VDC output

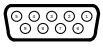
Fieldbus Connection, J4 (Fieldbus option required)

This Female DB-9 connector is connected to the Fieldbus module inside the board and the communication to the network will be conducted through this port. This will have different pin out descriptions based on the module installed in the controller.

Profibus		
J4 **DB9 Female**		
Pin #	**Symbol**	**Function**
1	N.C.	
2	+5VDC	Positive Power Supply
3	RXD/TXD-P RS 485	Receive / Send Data –P
4	CNTR-P	Control Counter TTL
5	DGND*	Reference Ground *
6	+5VDC	Positive Power Supply
7	N.C.	
8	RXD/TXD-N RS 485	Receive / Send Data -N
9	N.C.	
* E8 jumper should be in 1-2 position		

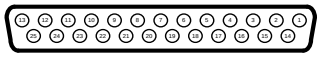
CANopen		
J4 DB9 Female		
Pin #	**Symbol**	**Function**
1	N.C.	
2	CAN_L	CAN_L Bus line ISO 11898
3	CAN_GND	CAN Ground
4	N.C.	
5	N.C.	
6	N.C.	
7	CAN_H	CAN_H Bus line ISO 11898
8	N.C.	
9	N.C	

DeviceNet		
J4 DB9 Female		
Pin #	**Symbol**	**Function**
1	V+	DeviceNet +24V Power Supply
2	CAN_H	CAN High Signal
3	V-	DeviceNet V- Reference Potential
4	N.C.	
5	SHELL	Shield*
6	CAN_H	CAN High Signal
7	N.C.	
8	N.C.	
9	CAN_L	CAN Low Signal
* E8 jumper should be in 2-3 position		

CC-Link		
J4 DB9 Female		
Pin #	**Symbol**	**Function**
1	SLD	CC-Link Shield
2	FG	CC-Link Function Ground
3	DATA A	CC-Link Data A
4		
5	DG	CC-Link Data Ground*
6	FG	CC-Link Function Ground
7		
8		
9	DATA B	CC-Link Data B
* E8 jumper should be in 2-3 position		

General Purpose I/O Connection, J5

The 25 pin D-Sub connector located on top of the controller provides 8 optically isolated inputs, 4 optically isolated outputs, and a controller watchdog output with both normally closed and normally open contacts. The connector also has an extra input which can be used as either sinking or sourcing input regardless of the other inputs setup.

J5 General Purpose I/O 25-pin Female D-Sub connector		
Pin #	**Symbol**	**Description**
1	IN1	Input 1
2	IN3	Input 3
3	IN5	Input 5
4	IN7	Input 7
5	IN RET	Input return line
6	OUT1 COL	Sinking output 1
7	OUT2 COL	Sinking output 2
8	OUT3 COL	Sinking output 3
9	OUT4 COL	Sinking output 4
10	COM EMT	GND Connection for sinking outputs [2]
11	WDO COM	Watchdog Common
12	WDO NO	Normally Open Contact
13	ESTOP-	E-Stop return line
14	IN2	Input 2
15	IN4	Input 4
16	IN6	Input 6
17	IN8	Input 8
18	COM COL	12-24 V input for sourcing outputs [1]
19	OUT1 EMT	Sourcing output 1
20	OUT2 EMT	Sourcing output 2
21	OUT3 EMT	Sourcing output 3
22	OUT4 EMT	Sourcing output 4
23	N.C.	
24	WDO NC	Normally Closed Contact
25	ESTOP+	+24 V input from Normally Closed E-Stop Button

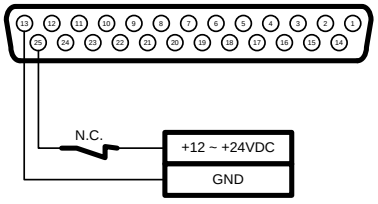
[1] to use sourcing outputs connect the +12 to +24V to pin 18 and use pins 19,20,21 & 22 as your sourcing outputs

[2] to use sinking outputs connect the GND to pin 10 and use pins 6,7,8 & 9as your sinking outputs.

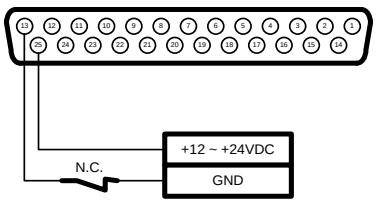
Emergency Stop Input

This input **must** be powered in order for the Panasonic Realtime Express to function. Any disconnection of the power on this input will kill the servo on all A4N/A5N drives.

This input can be reached at Y:$70801,4.



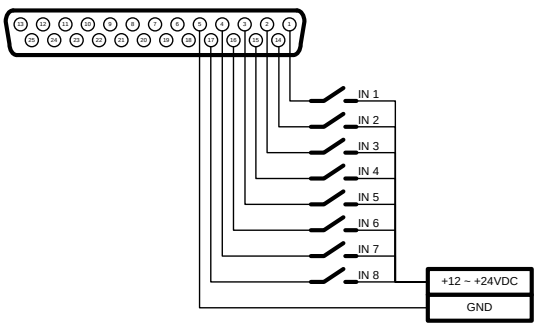
Sourcing Input



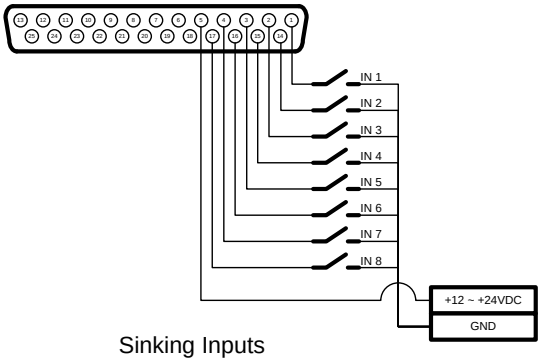
Sinking Input

Inputs wiring

There are 8 inputs on the I/O connector, which can be used as sinking or sourcing inputs.



Sourcing Input



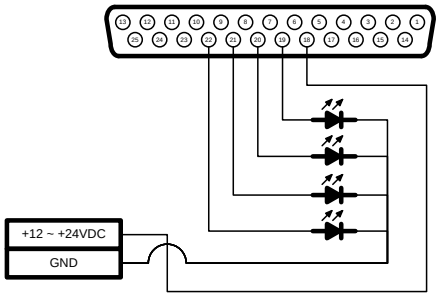
Sinking Inputs

To read the inputs assign the following M variables,

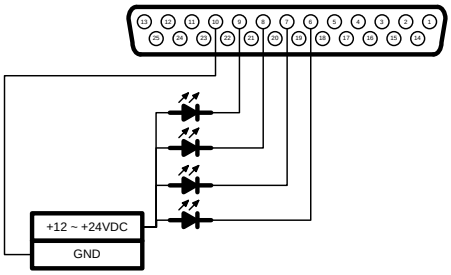
```
M0->Y:$78401,0     ; Input 1, J5 Pin 1
M1->Y:$78401,1     ; Input 5, J5 Pin 14
M2->Y:$78401,2     ; Input 2, J5 Pin 2
M3->Y:$78401,3     ; Input 6, J5 Pin 15
M4->Y:$78401,4     ; Input 3, J5 Pin 3
M5->Y:$78401,5     ; Input 7, J5 Pin 16
M6->Y:$78401,6     ; Input 4, J5 Pin 4
M7->Y:$78401,7     ; Input 8, J5 Pin 17

M8->X:$78401,0,8    ; I/O Direction Control
M8=$0               ; Set them as inputs
M9->Y:$78405,0,8    ; I/O Data Type Control
M9=$FF              ; Set them as I/O (Not necessary since they are
always set to one)

M10->X:$78405,0,8   ; I/O Inversion Control
M10=$FF             ; $FF represents 1 for high and 0 for low input
```

Outputs wiring

There are 4 outputs on the I/O connector, which can be used in sinking or sourcing mode. Since these outputs share some circuitary, you can only use one type (sinking or sourcing) at a time. The maximum current that these outputs can supply is 900mA on each output.



Sourcing Outputs



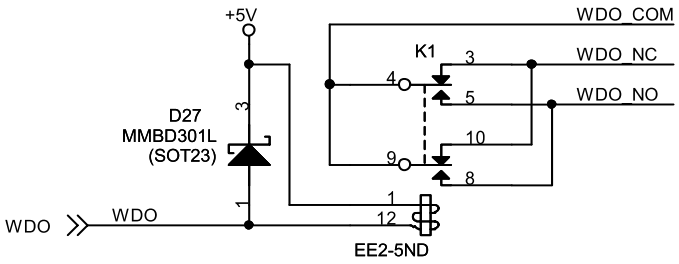
Sinking Outputs

To write to the outputs you need to define these M variables:

```
M52->Y:$078402,2        ; DAT2 Line; J2 Pin 6 or 19
M53->Y:$078402,3        ; DAT3 Line; J2 Pin 7 or 20
M54->Y:$078402,4        ; DAT4 Line; J2 Pin 8 or 21
M55->Y:$078402,5        ; DAT5 Line; J2 Pin 9 or 22

M60->X:$078402,0,8      ; Direction control for DAT0 to DAT7
M61->Y:$078406,0,8      ; Data type control DAT0 to DAT7
M62->X:$078406,0,8      ; Data inversion control

M60=$FF           ;Setting the Direction control to 1, meaning outputs
M61=$FF           ;Setting data type to DATA on DAT0 to DAT7
M62=$0            ;Data inversion control for DAT0 to DAT7
```

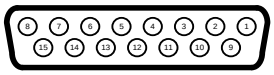
Watchdog Relay wiring

In addition to the I/O points and the E-stop on General Purpose I/O connector, the user can monitor the status of the controller by accessing the watchdog relay. As long as the controller is powered up and the watchdog has not been tripped (indicating a functional controller), the relay is energized. As soon as the watchdog trips, the relay will be de-energized. Both normally closed and normally open contacts are available on pins 24 and 12 consequently with common contact on pin 11.



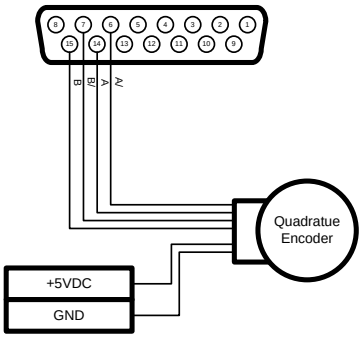
Auxiliary Connector, J8

The 15-pin DB style female connector contains connections for handwheel quadrature input, two ADC inputs, one DAC output and one pulse and direction output. Please check the software setup and connector pin out sections for more information on how to use each of these features.

J8 AUX DB15 Female		
Pin #	**Symbol**	**Function**
1	ADC1-	Analog-to-Digital input, negative signal or DGND[1]
2	ADC2-	Analog-to-Digital input, negative signal or DGND[1]
3	DAC1-	±10VDC output, inverted
4	DIR1-	Direction output, inverted
5	PUL1-	Pulse output, inverted
6	HW1_CHA1-	Handwheel Quadrature input A/
7	HW1_CHB1-	Handwheel Quadrature input B/
8	DGND	Digital Ground
9	ADC1+	Analog-to-Digital input, positive signal
10	ADC2+	Analog-to-Digital input, positive signal
11	DAC1+	±10VDC output
12	DIR1+	Direction output
13	PUL1+	Pulse output
14	HW1_CHA1+	Handwheel Quadrature input A
15	HW1_CHB+	Handwheel Quadrature input B
[1] to use the ADCs with single ended signal, connect the ADC1- and ADC2- to pin 8 DGND		

Handwheel Wiring

The handwheel wiring should be done as shown in the following figure. You can use differential or single-ended signals from any quadrature encoder. Make sure that you tie the ground connection of the encoder to the ground connection of the J8 if you're planning to use single-ended encoder. Since there is no power output pin available on J8, you need to power up the encoder from a separate source (a.e. JTHW).



Handwheel Wiring

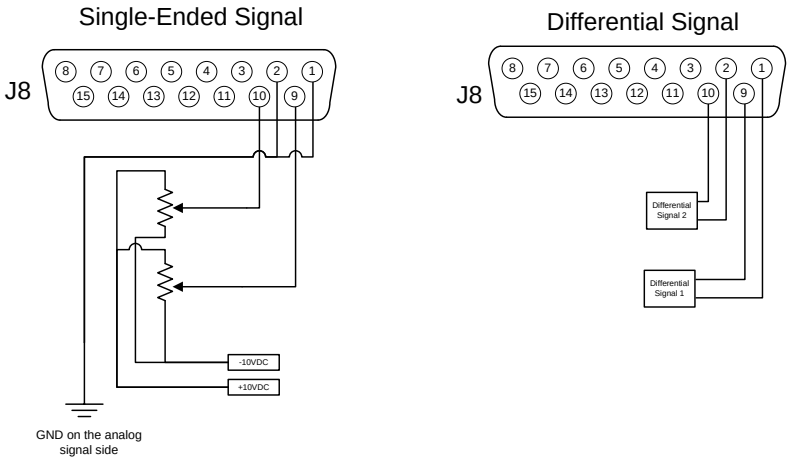
To read the handwheel counts, you need to implement these settings in Encoder Conversion Table:

```
I8000=$78410
M1010->X:$3501,0,24,s
```

You can access the position of the handwheel. You can also use the same address ($3501) as a master address for any of the motors (Ixx05)

Analog-to-Digital Connections (Option 12 required)

There are two analog-to-digital circuits on J8 which can have 12-bit or 16-bit resolution based on the requested options. The signal can be either differential or single-ended. In single-ended configuration, the input range can be ±10VDC in contrast with ±5VDC in differential signal setting.



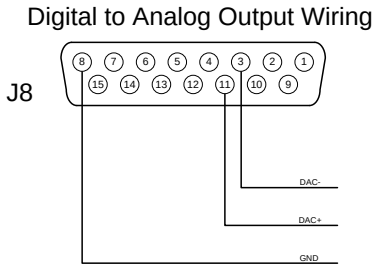
To read the value of the ADCs, make sure that you have the correct strobe word written to the ADCs. The ADC values can be read using M-variables with the following definitions:

Option 12 : 12 bit Analog to Digital option

```
I6806=$1FFFFF
M63->Y:$078406,8,8      ; Data type control SEL0 to SEL7

M63=$0;

M1001->Y:$78415,8,12,S
M1002->Y:$78416,8,12,S
```

Digital-to-Analog Connection

The digital-to-analog output has a range of ±10VDC and can source 20mA current. The output signal is in differential mode and can be used as either differential or single-ended mode.



To write into the DAC output:

```
I6816=0                  ;set the channel output type to PWM output
M1005->Y:$78414,8,16,S
```

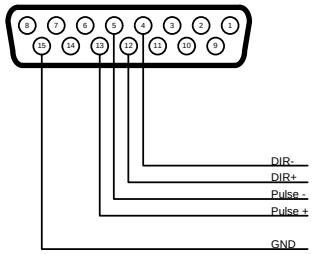
By changing the value of M1005 in a range of ±I6800, you can have ±10VDC output on your DAC output.

Note:

Please note that the DAC output is a filtered PWM signal and is limited by the max phase settings which cannot be changed because of Realtime Express network requirements.

Pulse and Direction Output

This output can be connected to any stepper motor amplifier or can be used to generate pulses for any other application. Since the phase and servo clock cycle times is preset at Realtime Express network's update rate, the maximum output frequency with default settings is 327kHz which can be increased to 1.31 MHz by changing the PFM clock divider (I6803)



Pulse & Direction Wiring

To output Pulse and Direction on the handwheel port :

```
I6826=3                  ;set the channel output to PFM mode
M1006->Y:$7841C,0,24,s
```

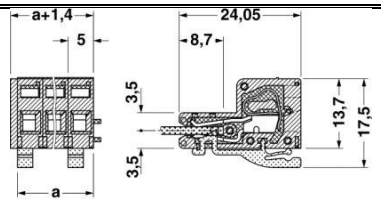
By changing the value of m1006 you can select the direction and the frequency of the pulses.

24 VDC Power Supply Input, J9

An external 24VDC power supply is required to power the Turbo PMAC2 Eth Ultralite. The 24V is wired into connector J9. The polarity of this connection is extremely important. Carefully follow the instructions in the wiring diagram. This connection can be made using 16 AWG wire directly from a protected power supply. In situations where the power supply is shared with other devices, it may be desirable to insert a filter in this connection.

The power supply providing this 24V must be capable of providing an instantaneous current of at least 900 mA. In the case where multiple devices are driven from the same 24V supply, it is recommended that each device be wired back to the power supply terminals independently

The connector for J9 is a Phoenix PCB Edge connector ZEC 1,5/ 3-ST-5,0 C2 R1,3 with Delta Tau part number 014-188305-001 and Phoenix part number 18883051.

J9 24V DC Input Phoenix PCB Edge Connector		
Pin #	**Symbol**	**Function**
1	GND	Ground Connection from power supply
2	N.C.	
3	+24V	+24VDC input from power supply

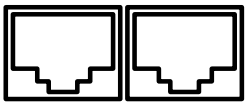
MACRO Connector

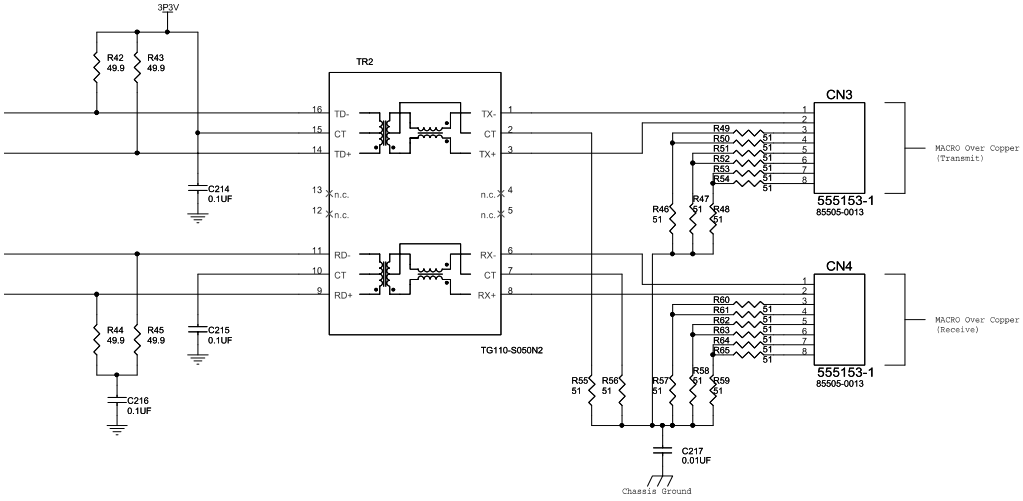
Based on the option that you have, either the MACRO fiber connector or the MACRO RJ45 connector will be installed on the controller.

- Option A provides the MACRO-ring fiber optic SC-style interface connector. The key component on the board is U49.

MACRO SC-Style Fiber Connector CN3 and CN4		
Pin #	**Symbol**	**Function**
1	IN	MACRO Ring Receiver
2	OUT	MACRO Ring Transmitter
1. The fiber optic version of MACRO uses 62.5/125 multi-mode glass fiber optic cable terminated in an SC-style connector. The optical wavelength is 1,300nm. 2. It is possible to "adapt" wire to fiber operation when using OPT B.		

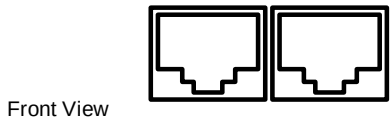
• Option C provides the MACRO-ring RJ-45 electrical interface connectors. The key components on the board are CN3 and CN4.

MACRO RJ45 Connector CN3 and CN4		Front View  OUT IN
Pin #	**Symbol**	**Function**
1	DATA+	Differential MACRO Signal. CN4: DATA+ input. CN3: DATA+ output.
2	DATA-	Differential MACRO Signal. CN4: DATA- input. CN3: DATA- output.
3	Unused	Unused terminated pin. See schematic below.
4	Unused	Unused terminated pin. See schematic below.
5	Unused	Unused terminated pin. See schematic below.
6	Unused	Unused terminated pin. See schematic below.
7	Unused	Unused terminated pin. See schematic below.
8	Unused	Unused terminated pin. See schematic below.



Realtime Express Connector

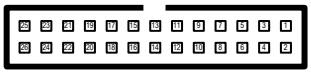
These connectors are used to establish the Realtime Express Ring between the controller and Panasonic's A4N/A5N drives.

Realtime Express RJ45 Connector CN1 and CN2		
Pin #	**Symbol**	**Function**
1	CT	
2	CT	
3	TX- / RX-	
4	CT	
5	CT	
6	TX+ /RX+	
7	CT	
8	CT	

Thumbwheel Multiplexer Port (JTHW Port), J10

The Thumbwheel Multiplexer Port, or Multiplexer Port, on the JTHW connector has eight input lines and eight output lines. The output lines can be used to multiplex large numbers of inputs and outputs on the port, and Delta Tau provides accessory boards and software structures (special M-variable definitions) to capitalize on this feature. Up to 32 of the multiplexed I/O boards may be daisy-chained on the port, in any combination.

1. 26-pin female flat cable connector T&B Ansley P/N 609-2641
2. Standard flat cable stranded 26-wire T&B Ansley P/N 171.26
3. Phoenix varioface module type FLKM 26 (male pins) P/N 22 81 05 0

J10 Thumbwheel Port 26 Pin IDC Header Reciprocal				
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	GND	Common	PMAC Common	
2	GND	Common	PMAC Common	
3	DAT0	Input	Data-0 Input	Data input from multiplexed accessory
4	SEL0	Output	Select-0 Output	Multiplexer select output
5	DAT1	Input	Data-1 Input	Data input from multiplexed accessory
6	SEL1	Output	Select-1 Output	Multiplexer select output
7	DAT2	Input	Data-2 Input	Data input from multiplexed accessory
8	SEL2	Output	Select-2 Output	Multiplexer select output
9	DAT3	Input	Data-3 Input	Data input from multiplexed accessory
10	SEL3	Output	Select-3 Output	Multiplexer select output
11	DAT4	Input	Data-4 Input	Data input from multiplexed accessory
12	SEL4	Output	Select-4 Output	Multiplexer select output
13	DAT5	Input	Data-5 Input	Data input from multiplexed accessory
14	SEL5	Output	Select-5 Output	Multiplexer select output
15	DAT6	Input	Data-6 Input	Data input from multiplexed accessory
16	SEL6	Output	Select-6 Output	Multiplexer select output
17	DAT7	Input	Data-7 Input	Data input from multiplexed accessory
18	SEL7	Output	Select-7 Output	Multiplexer select output
19	N.C.	N.C.	No Connection	
20	GND	Common	PMAC Common	
21	N.C.	N.C.	No Connection	
22	GND	Common	PMAC Common	
23	N.C.	N.C.	No Connection	
24	GND	Common	PMAC Common	
25	+5V	Output	+5VDC Supply	Power Supply output
26	INIT-	Input	PMAC Reset	Low is Reset
The JTHW multiplexer port provides 8 inputs and 8 outputs at TTL levels. While these I/O can be used in unmultiplexed form for 16 discrete I/O points, most users will utilize PMAC software and accessories to use this port in multiplexed form to greatly multiply the number of I/O that can be accessed on this port. In multiplexed form, some of the SELn outputs are used to select which of the multiplexed I/O are to be accessed.				

How to use THW Port with Acc-34:

1. Set i29=$78400
2. save
3. $$$
4. Follow the setup for Acc-34

How to use THW Port as general purpose IO (8 Input and 8 Output):

1. WX:$78400, $FF00 ;IO Direction Control
2. WY:$78404, $FFFF ;IO Data Type Control
3. WX:$78404, 0 ;IO Inversion Control

M1000->Y:$78400,0,8 ;8 Inputs
M1001->Y:$78400,8,8 ;8 Outputs

SOFTWARE SETUP

Host Communications

To communicate with Turbo PMAC2 Realtime Express Controller from your host computer, you can use any of the provided communication ports. The choice only affects the speed at which you will be talking to the controller. You can communicate with the controller over the Serial communication or Ethernet ports without any special software. A standard communications program such as HyperTerminal can be used on these ports, but the PMAC Executive PRO 2 Suite is still recommended for development.

For Serial RS-232 communications, please check the J7 pin outs for proper serial communication. For Ethernet communication, the default IP address is 192.6.94.5. You can use any terminal program to talk to the controller over these ports.

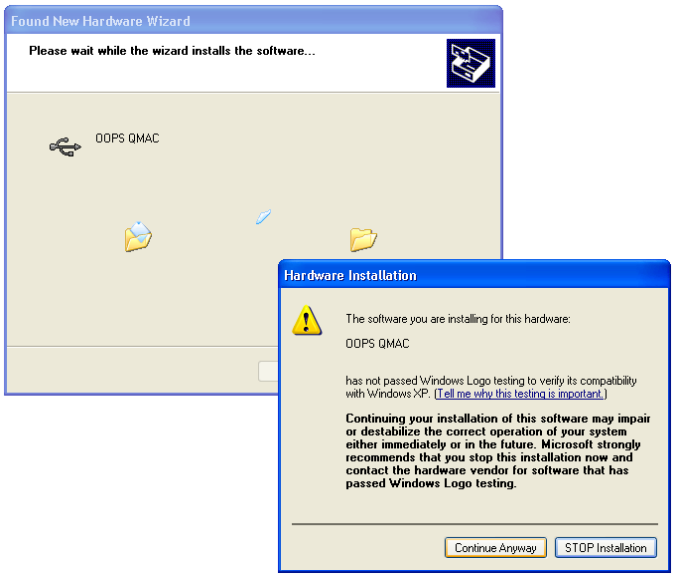
In order to get the most out of the controller, we recommend using Delta Tau's PMAC Executive Pro2 Suite for communication. The PMAC Executive Pro2 Suite is designed to communicate with all Delta Tau products. Although the suite includes setup software programs for different types of controllers, you will not be using all of them.

The PEWIN32PRO2 is the main program used to set up your system and is needed for your application development and troubleshooting. You can also use the PMAC Plot Pro2 to use the powerful functionality of gathering information on the controller.

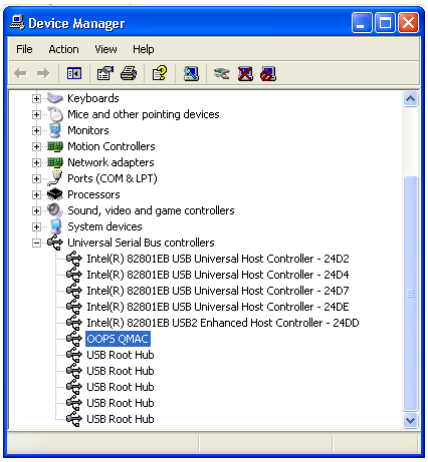
Pewin32PRO2 Communication Setup

First, connect the controller to your PC. You don't need any driver to get connected to the controller using the Serial or Ethernet port. Once you plug in the USB port, the Windows Plug and Play system will detect the controller and install the appropriate driver for communication. If you install the PMAC Executive Pro2 Suite before connecting the USB connection, Windows will detect the communication driver automatically.

Select the automatic installation of the drivers and click **Next**.

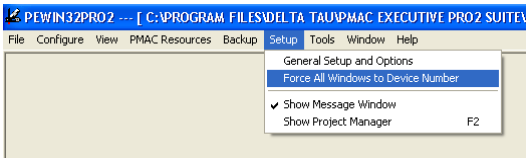


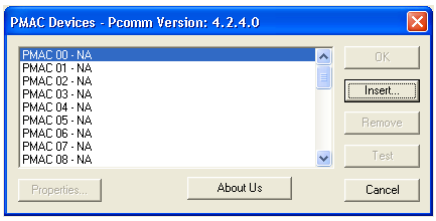
A window will appear, stating it cannot verify the compatibility of the driver with Windows XP. Click on **Continue Anyway** button and the driver will be installed on your computer. You should then be able to see the device in the Windows Device Manager.



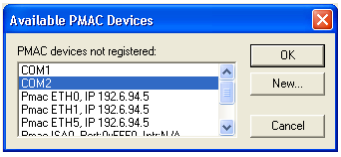
Once you have established the connection between the controller and the computer, start your software by clicking on Pewin32PRO2 icon either from your desktop or from the Start menu.

From the Setup menu, select on **Force All Windows to Device Number.**



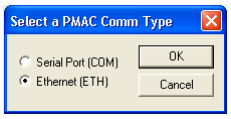


Click **Insert**.

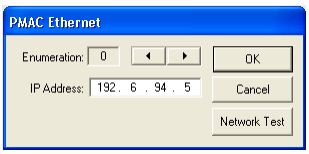


Select the communication port from the list. All the available Serial ports (COM1, COM2, …) and Delta Tau USB products are present on this list.

When trying to communicate through an Ethernet port and the IP address for the PMAC is not in the list, click **New**:

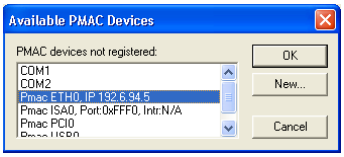


Select the Ethernet (Eth) option and click **OK**.

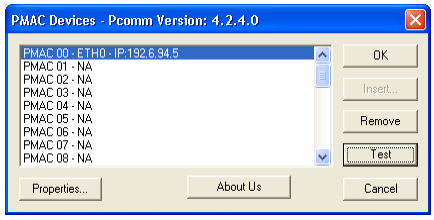


Enter the IP address of the controller. The Default IP address for all Delta Tau Products is 192.6.94.5 . If you need to change this default address, you can do so by using Configure Ethernet 100BaseT software, which can be accessed from PMAC Executive PRO 2 Suite / Delta Tau Common folder under Start Menu.

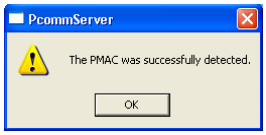
After selecting the communication port with the controller, click **OK**.



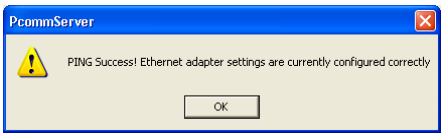
The selected device is now added to the list, and it is referred as PMAC ##. You can have up to 32 PMAC devices defined on the software.



To check the communications, click **Test**. If communication is established, you will see the following confirmation window:



In case of Ethernet Communication, the Pcommserver will report the result of PING command to the network driver chip on the controller before trying to communicate to the controller CPU.



Once the communication is established, you can use any of the windows and tools provided by the Pewin32PRO2 software and accompanied tools.

Realtime Express Network Specific Configuration Setup

The Turbo PMAC2 Realtime Express Controller is a part of Turbo PMAC 2 family of controllers which has been loaded with custom user-written phase and servo algorithms to communicate with Panasonic drives.

The software consists of two parts. All you need to do is to change the download file "panadwld.pmc" based on your particular Realtime Express network settings. The download file will include a few other files in which you don't need to change. This process is only necessary the first time that you want to setup a network or if you have reset the card back to factory default settings either by issuing a $$$*** command and saving it or after powering up while holding the SW2 (Re-Init).

You can download these files from Delta Tau's website www.deltatau.com

Once you open the PANADWLD.PMC file with PEWIN32Pro or Pro2 software and download it to the controller, you need to issue a **Save** command. After the save command has been issued, issue a command cycle power on the controller.

Realtime Express Network Setup – Step by Step

Although the software package needed for Realtime Express setup includes several files, you only need to modify one file in order to set up the controller. The file to modify based upon the settings of your network is called "PANADLWD.PMC"

First, establish communication with the controller through the PEWIN32PRO2 software. From the **File** menu, then select **Open File** and open "PANADLWD.PMC". Make sure that you have unpacked all the files included in the package under the same folder and that you have read/write access to that folder.

There is sufficient explanation included in the file in order for you to edit the file easily. Here are the main changes needed for system setup.

1. **Number of Panasonic Motors:** (Line 45)
   Define the number of Panasonic A4N/A5N drives on the Realtime Express network (the number of Panasonic motors you have on the ring).

```
#define PanasonicMtrs 4
```

   In this example we have 4 motors on the Realtime Express network.

2. **MACRO option:** (Line 50)
   Define whether or not you have the MACRO ring option.

```
#define MACRO
```

   If you do not have the MACRO option, comment out this whole line.

```
// #define MACRO
```

3. **Clock Settings:** (Line 54)
   It's possible to have different clock settings on the Turbo PMAC2 Realtime Express controller. However, here are the suggested values:

```
#define MAXPHASE               7368
#define MAXPHASE_TO_PHASE_DIV  3
#define PHASE_TO_SERVO_DIV     0
CLK_DIV_SAVE_M =               0
```

   If you only have the Panasonic Realtime Express network, these settings will always work for you and no changes are required.

   If you have the MACRO option in addition to Realtime Express, and you want to have higher PWM/Phase/Servo clock frequencies than the Panasonic Realtime Express default, you can choose a setting from the following table:

Update Period (ms)	Com. Period (ms)	Servo Freq. (kHz)	Phase Freq. (kHz)	MAXPHASE	MAXPHASE_TO_PHASE_DIV	PHASE_TO_SERVO_DIV	CLK_DIV_SAVE_M
1.000	1.000	1.000	1.000	58982	0	1	0
1.000	0.500	1.000	2.000	29491	0	2	0
0.500	0.500	2.000	2.000	29491	0	1	0
0.167	0.167	6.000	6.000	9830	0	1	0
0.167	0.083	6.000	12.000	4915	0	2	0

Choose the best fitted PWM/Phase clock for your system and set the MAXPHASE, MAXPHASE_TO_PHASE_DIV, PHASE_TO_SERVO_DIV and CLK_DIV_SAVE_M based upon the table.

The MAXPHASE parameter will be controlling the frequency of Max Phase clock of the PMAC which other clocks are divider from (I6800).

MAXPHASE_TO_PHASE_DIV specifies the divider from Max Phase clock to Phase clock, and PHASE_TO_SERVO_DIV will determine the divider which generates the Servo clock from the Phase clock.

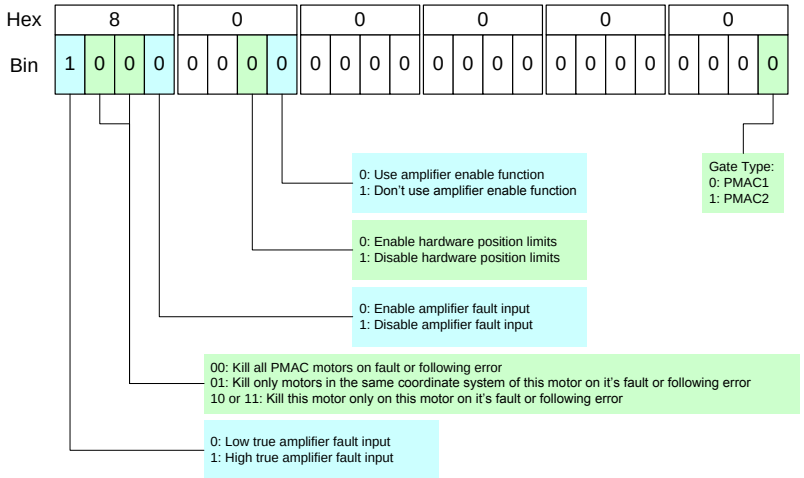
As shown in the table, the CLK_DIV_SAVE_M variable defines an additional divider from Phase clock to Realtime Express clock. Because of the architecture of the Panasonic's Realtime Express, this clock needs to be set at 2 kHz, the update rate of the data from PMAC to Panasonic.

Please note that since the Servo clock in some cases might be faster than what Panasonic drives accept, we should adjust the Servo calculation frequency of Panasonic motors by changing their Ixx60 value. The proper value for Ixx60 is provided in the table. Please note that changing of Ixx60 is only needed for Panasonic motors on the Realtime Express network and not on any other motor on the MACRO ring.

4. Flag Mode Control: (Line 97)

Please refer to the Turbo PMAC Software Reference Manual for detailed information on setting this parameter. Remember that the Panasonic's A4N/A5N drives have high true amplifier fault signal, so the default value will be: $800000

Here is a quick guide on setting Ixx24 of the motors:



```
I124,PanasonicMtrs,100=$800000
```

5. **Absolute Position Capture:** (Starting at line 102)
   By default, these variables read the absolute position of the motor from the A4N/A5N drives. If you don't have an absolute encoder, it's still acceptable to keep these values since they will return a zero on power up.

   The user has to comment out the I-variables for motors which are not on the Realtime Express network. In this example, only the first four motors are being used.

```
I110 = $1C05
I210 = $1C0D
I310 = $1C15
I410 = $1C1D
/*
I510 = $1C25
I610 = $1C2D
```

   Note that you have to place the **/*** sign one line after the last motor number used for the Panasonic network.

6. **Flag Status Word:** (Starting at line 148)

   The user has to comment out the I-variables for motors which are not on the Realtime Express network. In this example, only the first four motors are being used.

```
I125=$A4
I225=$124
I325=$1A4
I425=$224
/*
I525=$2A4
I625=$324
```

   Note that you have to place the **/*** sign one line after the last motor number used for the Panasonic network.

7. **Position and Velocity Feedback:** (Starting at line 186)

   The user has to comment out the I-variables for motors which are not on the Realtime Express network. In this example, only the first four motors are being used.

```
I103=$A6
I104=$A6
I203=$126
I204=$126
I303=$1A6
I304=$1A6
I403=$226
I404=$226
/*
I503=$2A6
I504=$2A6
```

```
I603=$326
I604=$326
```

Note that you have to place the **/*** sign one line after the last motor number used for the Panasonic network.

8. Panasonic TX Block and MacID Number of motor xx: (Starting at line 267)

Ixx30 and Ixx31 must match the order block number and MacID of the ring even though the node might be an I/O node. Slave I/O nodes should be put in the Ixx30 and Ixx31 variables after the Servo nodes. There can be no GAPS in the Ixx30/31 variables. For example, you cannot use Motor 5's I530/531 variables if you only have four nodes. Also, this code only supports one block slave nodes.

The user has to comment out the I-variables for motors which are not on the Realtime Express network. In this example, only the first four motors are only being used. It is assumed that the first A4N/A5N drive on the downstream of the TP2RTEX is connected to Motor 1 and the MacID of it is set to 0. The second drive is connected to Motor 2 and MacID is set to 1 and so on.

```
I130=0
I131=0
I230=1
I231=1
I330=2
I331=2
I430=3
I431=3
/*
I530=4
I531=4
I630=5
I631=5
```

Note that you have to place the **/*** sign one line after the last motor number used for the Panasonic network.

9. Panasonic Homing Type Code: (Starting at line 365)

The Ixx33 variable will determine the homing routine of motor xx. In the default download file, all the motors are set to home, based upon index high.

```
I133,PanasonicMtrs,100=$11
```

If you want to have different homing routines for different motors, you have to replace the Ixx33 definition with individual setting for each motor. As an example:

```
I133=$11    ;home on C channel
I233=$12    ;home on rising edge of the home flag
I333=$13    ;home on falling edge of the home flag
I433=$11    ;home of C channel
```

```
```

10. **Fatal Following Error Limit:** (Starting at line 378)

    Although the PMAC can monitor and take action based upon the following error of each motor, Panasonic suggests that the drive will determine the fatal following error and this feature is not to be used in PMAC, hence the value is set to zero. However, if the user decides to use the PMAC's following error monitor, this I-variable can be used.

```
I111,PanasonicMtrs,100=0
```

11. **Warning Following Error Limit:** (Starting at line 379)

    Although the PMAC can monitor and take action based upon the following error of each motor, Panasonic suggests that the drive will determine the following error and this feature not to be used in PMAC, hence the value is set to zero. However, if the user decides to use the PMAC's following error monitor, this I-variable can be used.

```
I112,PanasonicMtrs,100=0
```

12. **Ixx11's saved value during Homing:** (Starting at line 386)

    If the user chooses to use Ixx11 by setting it to a value other than zero, the same value should be assigned to Ixx32.

```
I132,PanasonicMtrs,100=0
```

13. **Ixx12's saved value during Homing:** (Starting at line 391)

    If the user chooses to use Ixx12 by setting it to a value other than zero, the same value should be assigned to Ixx35.

```
I135,PanasonicMtrs,100=0
```

14. **MACRO Settings:** (Starting at line 402)

    If the user has MACRO communication option enabled, the most common settings are pointed out after this section of the file. For more detailed information on MACRO setup, refer to the Delta Tau MACRO Software Reference Manual and the MACRO hardware specific manual.

15. **Save the file:**
    Save the modified file under the original name.

16. **Reset the controller:**

Reset the controller by issuing a **$$$***** command in the terminal window.

17. **Download the configuration file.**

18. **Save the configuration to the PMAC:**
    Save the configuration to the PMAC by issuing a "**SAVE**" command in the terminal window of PEWIN32PRO2.

```
SAVE
```

19. **Reset the controller:**
    Reset the controller by issuing a "**$$$**" command in the terminal window.

```
$$$
```

20. **Clear and Reset the Realtime Express network:**
    Reset and clear the errors on the Realtime Express network by setting **M8123=8.**

```
M8123=8
```

21. **Download any other user configuration files and/or programs, PLCs, etc.**

I-Variable Definitions

As described in the PANADWLD.PMC file, there are certain I-variables that you need to set for your ring setup. Also there are a certain number of resources and functions that have been limited to the user, which are listed below. If a specific I-variable is not listed here, you may assume that it has the same usage described in Delta Tau's Turbo Software Reference Manual.

RESERVED M & P VARIABLE FOR PANASONIC IMPLEMENTATION

- M8100 - M8191
- P8191

Since these variables have been used in user-written servo, phase and PLCC1, writing into these variables or changing their definition can cause unexpected behavior in the system.

UNAVAILABLE PMAC COMMANDS FOR PANASONIC IMPLEMENTATION

Certain PMAC commands are not available on the Realtime Express Controller. These commands can stop the controller by stopping the network from:

- HMZ
- HM1..32 (home search command from any motion program)
- $$$ (To reset power cycle, or command M8123 = 8 in terminal window)
- $$$*** but then must reload Panasonic, SAVE and power cycle
- $ (To recover set M8123 = 5)
- Ctrl-D (To recover, power cycle)
- Any move until trigger
- Programming DISPLAY commands

RESERVED PMAC I-VARIABLES FOR PANASONIC IMPLEMENTATION

General Global Setup I-Variables

These I-variables should not be changed. They are specifically set for Realtime Express Network.

I5 **PLC Program Control**
Default: 3
Range: 1 or 3

I7 **Phase Cycle Extension**
Default: 0

I10 **Servo Interrupt Time (Set for Panasonic rate)**
Default: 8388607

Motor Setup I-Variables

Ixx00 **Motor Activation Control**
Must be set to 1 for each active motor.

I100 Motor 1 Activation Control should always be equal to 1. Meaning at least 1 drive/motor should be connected to the controller. This setting is done in the PANADWLD.PMC file.

Ixx01 Motor xx Commutation Enable

This should be 0 for all the motors **except** motor #1 for which the default value is 1 and should not be changed.

I101 Motor 1 Commutation Enable should always be 1

Ixx03 Motor xx Position Loop Feedback Address

I Variable	Value	I Variable	Value	I Variable	Value	I Variable	Value
I103	$A6	I903	$4A6	I1703	$8A6	I2503	$CA6
I203	$126	I1003	$526	I1803	$926	I2603	$D26
I303	$1A6	I1103	$5A6	I1903	$9A6	I2703	$DA6
I403	$226	I1203	$626	I2003	$A26	I2803	$E26
I503	$2A6	I1303	$6A6	I2103	$AA6	I2903	$EA6
I603	$326	I1403	$726	I2203	$B26	I3003	$F26
I703	$3A6	I1503	$7A6	I2303	$BA6	I3103	$FA6
I803	$426	I1603	$826	I2403	$C26	I3203	$1026

Ixx04 Motor xx Velocity Loop Feedback Address

I Variable	Value	I Variable	Value	I Variable	Value	I Variable	Value
I104	$A6	I904	$4A6	I1704	$8A6	I2504	$CA6
I204	$126	I1004	$526	I1804	$926	I2604	$D26
I304	$1A6	I1104	$5A6	I1904	$9A6	I2704	$DA6
I404	$226	I1204	$626	I2004	$A26	I2804	$E26
I504	$2A6	I1304	$6A6	I2104	$AA6	I2904	$EA6
I604	$326	I1404	$726	I2204	$B26	I3004	$F26
I704	$3A6	I1504	$7A6	I2304	$BA6	I3104	$FA6
I804	$426	I1604	$826	I2404	$C26	I3204	$1026

Ixx08 Motor xx Position Scale Factor

Should be set to 8

Ixx09 Motor xx Velocity-Loop Scale Factor

Should be set to 8

Ixx10 Motor xx Power-On Servo Position Address

If you have absolute feedback and the value is being sent over the RX buffer in the same memory location of Actual position, you can set up the power-on position address Ixx10 based on the following values:

I Variable	Value	I Variable	Value	I Variable	Value	I Variable	Value
I110	$1D05	I910	$1D45	I1710	$1D85	I2510	$1DC5
I210	$1D0D	I1010	$1D4D	I1810	$1D8D	I2610	$1DCD
I310	$1D15	I1110	$1D55	I1910	$1D95	I2710	$1DD5
I410	$1D1D	I1210	$1D5D	I2010	$1D9D	I2810	$1DDD
I510	$1D25	I1310	$1D65	I2110	$1DA5	I2910	$1DE5
I610	$1D2D	I1410	$1D6D	I2210	$1DAD	I3010	$1DED
I710	$1D35	I1510	$1D75	I2310	$1DB5	I3110	$1DF5
I810	$1D3D	I1610	$1D7D	I2410	$1DBD	I3210	$1DFD

Motor Safety I-Variables

Ixx11 Motor xx Fatal Following Error Limit

By default, the controller will not check for following error and the drive will monitor for any following errors. The reason is that the following error reported back to PMAC includes a delay because of the network update rate, which can translate into unrealistic following errors at higher speeds.

You can always turn this feature on by setting it to any number greater than zero. Make sure that the fatal following error is less than the following error set on the drive, or the over current protection will stop the drive with error 16 (Over-Current).

Note

When setting the Ixx11, make sure that you store the same value in Ixx32 as the default value of your following error. Ixx11 would be changed to a different value while homing procedure and the value in Ixx32 would be written back once the homing is complete.

Ixx12 Motor xx Warning Following Error Limit

By default, the controller will not check for warning following error. The reason is that the following error reported back to PMAC includes a delay because of the network update rate, which can translate into unrealistic following errors at higher speeds.

Note

When setting the Ixx12, make sure that you store the same value in Ixx35 as the default value of your following error. Ixx12 would be changed to a different value while homing procedure and the value in Ixx35 would be written back once the homing is complete.

Motor Motion I-Variables

Ixx24 Motor xx Flag Mode Control (Is a PMAC 1 Type)

Since the amp-fault is a low true on the Panasonic drives, you need to have bit 23 set to 1. ($800000)

Ixx25 Motor xx Flag Address

I-Variable	Value	I-Variable	Value	I-Variable	Value	I-Variable	Value
I125	$A4	I925	$4A4	I1725	$8A4	I2525	$CA4
I225	$124	I1025	$524	I1825	$924	I2625	$D24
I352	$1A4	I1125	$5A4	I1925	$9A4	I2725	$DA4
I425	$224	I1225	$624	I2025	$A24	I2825	$E24
I525	$2A4	I1325	$6A4	I2125	$AA4	I2925	$EA4
I625	$324	I1425	$724	I2225	$B24	I3025	$F24
I725	$3A4	I1525	$7A4	I2325	$BA4	I3125	$FA4
I825	$424	I1625	$824	I2425	$C24	I3225	$1024

Motor xx PID Servo Setup I-Variables

Ixx30 Motor xx PID Proportional Gain

(USED FOR A DIFFERENT PURPOSE WITH PANASONIC)
Panasonic TX Block Number
Ixx30 is the Panasonic TX Block number for the xx Motor. Needs completion for number of Panasonic motors.

Ixx31 Motor xx PID Derivative Gain

(USED FOR A DIFFERENT PURPOSE WITH PANASONIC)
Panasonic Mac ID Number
Ixx31 is the Panasonic Mac ID number for the xx Motor. Needs completion for number of Panasonic motors.

NOTE

Ixx30 and Ixx31 must match the order block number and Mac ID of the Ring even though the node might be an I/O node. Slave I/O nodes should be put in the Ixx30 & 31 variables after the Servo nodes. There can be no GAPS in the Ixx30/31 variables. For example, you cannot use Motor 5's I530/531 variables if you only have 4 Nodes.

Important:

Current Panasonic setup code only supports 1 block slave nodes.

Ixx32 Motor xx PID Velocity Feed forward Gain
(USED FOR A DIFFERENT PURPOSE WITH PANASONIC)
Fatal Following Error Limit Default Value
When setting the Ixx11, make sure that you store the same value in Ixx32 as the default value of your following error. Ixx11 would be changed to a different value while homing procedure and the value in Ixx32 would be written back once the homing is complete

Ixx33 Motor xx PID Integral Gain
(USED FOR A DIFFERENT PURPOSE WITH PANASONIC)
Panasonic Homing Type Code

Value	Homing Mode
$11	C Channel
$12	Rising edge of drive Home input
$13	Falling edge of drive Home input
$14	Rising edge of drive CCWL input
$15	Falling edge of drive CCWL input
$16	Rising edge of drive CWL input
$17	Falling edge of drive CWL input
$21	Actual Position Set
$31	Multi-turn date clear in absolute encoder

Ixx35 Motor xx PID Acceleration Feed forward Gain
(USED FOR A DIFFERENT PURPOSE WITH PANASONIC)
Warning Following Error Limit Default Value
When setting the Ixx12, make sure that you store the same value in Ixx35 as the default value of your following error. Ixx12 would be changed to a different value while homing procedure and the value in Ixx35 would be written back once the homing is complete

Motor Servo and Commutation Modifiers

Ixx59 Motor xx User-Written Servo/Phase Enable
(USED FOR A DIFFERENT PURPOSE WITH PANASONIC)

I-Variable	Value	I-Variable	Value	I-Variable	Value	I-Variable	Value
I159	3	I959	1	I1759	1	I2559	1
I259	1	I1059	1	I1859	1	I2659	1
I352	1	I1159	1	I1959	1	I2759	1
I459	1	I1259	1	I2059	1	I2859	1
I559	1	I1359	1	I2159	1	I2959	1
I659	1	I1459	1	I2259	1	I3059	1
I759	1	I1559	1	I2359	1	I3159	1
I859	1	I1659	1	I2459	1	I3259	1

Supplemental Motor Setup I-Variables

I6800/I6850/I6900/I6950 MACRO IC MaxPhase/PWM Frequency Control
(USED WITH SPECIFIC VALUE FOR PANASONIC)
I6800= 7371

I6801/I6851/I6901/I6951 MACRO IC Phase Clock Frequency Control230
(USED WITH SPECIFIC VALUE FOR PANASONIC)
I6801 = 3

I6802/I6852/I6902/I6952 MACRO IC Servo Clock Frequency Control230
(USED WITH SPECIFIC VALUE FOR PANASONIC)
I6802 = 1

UNUSABLE PMAC I-VARIABLES FOR PANASONIC IMPLEMENTATION

Ixx02 Motor xx Command Output Address
(NOT USED FOR PANASONIC)

Ixx26 Motor xx Home Offset
This value is not used and does not affect the home offset.

Ixx29 Motor xx Output/First Phase Offset..153
(NOT USED FOR PANASONIC)

Ixx34 Motor xx PID Integration Mode
(NOT USED FOR PANASONIC)

Ixx36 Motor xx PID Notch Filter Coefficient N1
(NOT USED FOR PANASONIC)

Ixx37 Motor xx PID Notch Filter Coefficient N2 .156
(NOT USED FOR PANASONIC)

Ixx38 Motor xx PID Notch Filter Coefficient D1
(NOT USED FOR PANASONIC)

Ixx39 Motor xx PID Notch Filter Coefficient D2
(NOT USED FOR PANASONIC)

Ixx40 Motor xx Net Desired Position Filter Gain
(NOT USED FOR PANASONIC)

Ixx41 Motor xx Desired Position Limit Band
(NOT USED FOR PANASONIC)

Ixx42 Motor xx Amplifier Flag Address
(NOT USED FOR PANASONIC)

Ixx43 Motor xx Overtravel-Limit Flag Address
(NOT USED FOR PANASONIC)

Ixx55 Motor xx Commutation Table Address Offset
(NOT USED FOR PANASONIC)

Ixx56 Motor xx Commutation Delay Compensation
(NOT USED FOR PANASONIC)

Ixx57 Motor xx Continuous Current Limit
(NOT USED FOR PANASONIC)

Ixx58 Motor xx Integrated Current Limit
(NOT USED FOR PANASONIC)

Ixx60 Motor xx Servo Cycle Period Extension Period
(NOT USED FOR PANASONIC)

Ixx61 Motor xx Current-Loop Integral Gain
(NOT USED FOR PANASONIC)

Ixx62 Motor xx Current-Loop Forward-Path Proportional Gain
(NOT USED FOR PANASONIC)

Ixx63 Motor xx Integration Limit
(NOT USED FOR PANASONIC)

Ixx64 Motor xx Deadband Gain Factor
(NOT USED FOR PANASONIC)

Ixx65 Motor xx Deadband Size
(NOT USED FOR PANASONIC)

Ixx66 Motor xx PWM Scale Factor
(NOT USED FOR PANASONIC)

Ixx67 Motor xx Position Error Limit
(NOT USED FOR PANASONIC)

Ixx68 Motor xx Friction Feed forward
(NOT USED FOR PANASONIC)

Ixx69 Motor xx Output Command Limit
(NOT USED FOR PANASONIC)

Motor Commutation Setup I-Variables

Ixx70 Motor xx Number of Commutation Cycles (N)
(NOT USED FOR PANASONIC)

Ixx71 Motor xx Counts per N Commutation Cycles
(NOT USED FOR PANASONIC)

Ixx72 Motor xx Commutation Phase Angle
(NOT USED FOR PANASONIC)

Ixx73 Motor xx Phase Finding Output Value
(NOT USED FOR PANASONIC)

Ixx74 Motor xx Phase Finding Time
(NOT USED FOR PANASONIC)

Ixx75 Motor xx Phase Position Offset
(NOT USED FOR PANASONIC)

Ixx76 Motor xx Current-Loop Back-Path Proportional Gain
(NOT USED FOR PANASONIC)

Ixx77 Motor xx Magnetization Current
(NOT USED FOR PANASONIC)

Ixx78 Motor xx Slip Gain
(NOT USED FOR PANASONIC)

Ixx79 Motor xx Second Phase Offset
(NOT USED FOR PANASONIC)

Ixx80 Motor xx Power-Up Mode
(NOT USED FOR PANASONIC)

Ixx81 Motor xx Power-On Phase Position Address
(NOT USED FOR PANASONIC)

Ixx82 Motor xx Current-Loop Feedback Address
(NOT USED FOR PANASONIC)

Ixx83 Motor xx Commutation Position Address
(NOT USED FOR PANASONIC)

Ixx84 Motor xx Current-Loop Feedback Mask Word
(NOT USED FOR PANASONIC)

Further Motor I-Variables

Ixx91 Motor xx Power-On Phase Position Format
(NOT USED FOR PANASONIC)

Ixx97 Motor xx Position Capture & Trigger Mode....197
(NOT USED FOR PANASONIC)

I3300 to I4899 should not be used.

Conversion Table I-Variables

I8000 - I8191 Conversion Table Setup Lines
Encoder conversion table is not being used by default settings. If the user needs to use it for any purpose, it is usable and will not cause any conflicts.

Using PMAC Motor Backlash Feature

Unlike a pure PMAC controller which calculates the trajectory and position of each motor and the servo control of each axis, in Turbo PMAC2 Realtime Express controller, the Panasonic drives are closing the position loop. This changes the way that PMAC introduces the backlash calculations to each motor.

In practice, the backlash take up and the backlash calculations should be completely invisible to the end user. Since the commanded position of the Panasonic motors are actually changing because of the backlash size, it takes some special care to use backlash compensation of the PMAC on Panasonic motors.

Before Activating the Backlash Feature

Each time you want to activate the backlash feature, you should follow these steps:

1. Make sure **motor present backlash** is zero. If not, you have to set it to zero while the motor is killed. Also make sure that the backlash direction bit in motor status word is zero – if not, write a zero to it.

Motor#	1	2	3	4	5	6	7	8
Address	Y:$0000E1	Y:$000161	Y:$0001E1	Y:$000261	Y:$0002E1	Y:$000361	Y:$0003E1	Y:$000461
Motor#	9	10	11	12	13	14	15	16
Address	Y:$0004E1	Y:$000561	Y:$0005E1	Y:$000661	Y:$0006E1	Y:$000761	Y:$0007E1	Y:$000861
Motor#	17	18	19	20	21	22	23	24
Address	Y:$0008E1	Y:$000961	Y:$0009E1	Y:$000A61	Y:$000AE1	Y:$000B61	Y:$000BE1	Y:$000C61
Motor#	25	26	27	28	29	30	31	32
Address	Y:$000CE1	Y:$000D61	Y:$000DE1	Y:$000E61	Y:$000EE1	Y:$000F61	Y:$000FE1	Y:$001061

2. Home the motor or establish the reference for the motor position.
3. Set **motor backlash take-up rate** (Ixx85), **motor backlash size** (Ixx86) and **motor backlash hysteresis** to desired values.
4. Command the axis as normal.

Before Deactivating the Backlash Feature:

1. Make sure **motor present backlash** is zero. If not, set it to zero by changing the **motor backlash size** (Ixx86) to zero.
2. Wait until **motor present backlash** becomes zero.
3. Set **motor backlash take-up rate** (Ixx85) and **motor backlash hysteresis** (Ixx87) equal to zero.
4. Check the direction of the backlash by looking at bit 4 of the motor status word. If it is equal to 1, write a zero to it.

Motor#	1	2	3	4	5	6	7	8
Address	Y:$C0,4	Y:$140,4	Y:$1C0,4	Y:$240,4	Y:$2C0,4	Y:$340,4	Y:$3C0,4	Y:$440,4
Motor#	9	10	11	12	13	14	15	16
Address	Y:$4C0,4	Y:$540,4	Y:$5C0,4	Y:$640,4	Y:$6C0,4	Y:$740,4	Y:$7C0,4	Y:$840,4
Motor#	17	18	19	20	21	22	23	24
Address	Y:$8C0,4	Y:$940,4	Y:$9C0,4	Y:$A40,4	Y:$AC0,4	Y:$B40,4	Y:$BC0,4	Y:$C40,4
Motor#	25	26	27	28	29	30	31	32
Address	Y:$CC0,4	Y:$D40,4	Y:$DC0,4	Y:$E40,4	Y:$EC0,4	Y:$F40,4	Y:$FC0,4	Y:$1040,4

Reading/Writing A4N/A5N Drive Parameters over the network

Although each drive can be accessed and setup through the RS-232 connector of the drive, Delta Tau's Turbo PMAC2 Realtime Express Controller allows the user to read / write / save all the parameters to any drive on the ring.

In order to read/change/save any of these parameters, you have to follow the following steps. As an example, we will disable the emergency stop input of motor #1.

1. Set CMD_TYPE (M8179) variable to 0.

```
M8179=0
```

2. Set PARAM_MTR_NUM (M8180) to desired motor number. Please note that this is the motor number and not necessarily the MacID of the drive.

```
M8180=1
```

3. Set PARAM_REQ (M8181) equal to a value representing read / write / save.

PARAM_REQ	Name	Description
$000	Parameter reading	Use this to read out the parameter value from the servo drive.
$001	Parameter writing	Use this to write the parameter value to the servo drive.
$101	EEPROM writing	Save the parameter value to EEPROM in the servo drive. Make sure to set the PARAM_NUM (M8182) and PARAM_DATA (M8183) equal to zero.

```
M8181=$001
```

4. If reading or writing to a parameter, set PARAM_NUM (M8182) equal to the parameter number based on following table. If saving the values to EEPROM of the drive, set PARAM_NUM equal to zero.

No.	Parameter Name	Default	No.	Parameter Name	Default
$0	For manufacturer use	1	$40	External Servo-ON enable	0
$1	LED display	0	$41	Emergency stop enable	1
$2	Control mode	0	$42	Home input logic	1
$3	Torque limit selection	1	$43	Direction of motion	1
$4	Over travel input inhibit	1	$44	Numerator of output pulse ratio	2500
$5	For manufacturer use	0	$45	Denominator of output pulse ratio	0
$6	Address indicated time at power up	0	$46	Pulse output logic inversion	0
$7	Speed monitor (SP) selection	3	$47	Z-phase of external scale setup	0
$8	Torque monitor (IM) selection	0	$48	For manufacturer use	10000
$9	Unit of velocity	0	$49	For manufacturer use	0
$0A	Inhibit parameter change via network	0	$4A	For manufacturer use	0
$0B	Absolute encoder set up	1	$4B	For manufacturer use	10000
$0C	Baud rate of RS232	2	$4C	Smoothing filter	1
$0D	Warning setup of cumulative COM error	0	$4D	FIR filter setup	0
$0E	Warning setup of continuous COM error	0	$4E	For manufacturer use	0
$0F	Update counter warning setup	0	$4F	For manufacturer use	0
$10	1st position loop gain	(63/32)	$50	For manufacturer use	500
$11	1st velocity loop gain	(35/18)	$51	For manufacturer use	1
$12	1st velocity loop integration time constant	(16/31)	$52	For manufacturer use	0
$13	1st speed detection filter	0	$53	For manufacturer use	0
$14	1st torque filter time constant	(65/126)	$54	For manufacturer use	0
$15	Velocity feed forward	-300	$55	For manufacturer use	0
$16	Feed forward filter time constant	-50	$56	For manufacturer use	0
$17	For manufacturer use	0	$57	For manufacturer use	0
$18	2nd position loop gain	(73/38)	$58	For manufacturer use	0
$19	2nd velocity loop gain	(35/18)	$59	For manufacturer use	0
$1A	2nd velocity loop integration time constant	-1000	$5A	For manufacturer use	0
$1B	2nd speed detection filter	0	$5B	For manufacturer use	0
$1C	2nd torque filter time constant	(65/126)	$5C	For manufacturer use	30
$1D	1st notch frequency	1500	$5D	For manufacturer use	0
$1E	1st notch width selection	2	$5E	1st torque limit	500
$1F	For manufacturer use	0	$5F	2nd torque limit	500
$20	Inertia ratio	-250	$60	In-position range	131
$21	Real time auto tuning set up	1	$61	Zero speed	50
$22	Machine stiffness at auto tuning	1-Apr	$62	For manufacturer use	0
$23	Adaptive filter mode	1	$63	In-position output setup	0
$24	Vibration suppression filter selection	0	$64	CT-offset re-calibration at servo-on	0
$25	Normal auto tuning motion setup	0	$65	Undervoltage error response at main power-off	1
$26	Software limit set up	10	$66	Error response at over travel limit	0
$27	Velocity observer	0	$67	Error response at main power-off	0
$28	2nd notch frequency	150	$68	Error response action	0
$29	2nd notch width selection	2	$69	Sequence at Servo-OFF	0
$2A	2nd notch depth selection	0	$6A	Mechanical brake delay at motor standstill	0
$2B	1st vibration suppression frequency	0	$6B	Mechanical brake delay at motor in motion	0
$2C	1st vibration suppression filter	0	$6C	External regenerative resistor setup (*2)	Mar-00
$2D	2nd vibration suppression frequency	0	$6D	Main power-off detection time	35
$2E	2nd vibration suppression filter	0	$6E	Emergency stop torque setup	0
$2F	Adaptive filter frequency	0	$6F	For manufacturer use	0
$30	2nd gain action setup	-1	$70	Position deviation error level	25000
$31	Gain switching mode	-10	$71	For manufacturer use	0
$32	Gain switching delay time	-30	$72	Overload level	0
$33	Gain switching level	-50	$73	Over speed level	0
$34	Gain switching hysteresis	-33	$74	Command update period	2
$35	Position loop gain switching time	-20	$75	For manufacturer use	0
$36	For manufacturer use	0	$76	For manufacturer use	0
$37	For manufacturer use	0	$77	For manufacturer use	0
$38	For manufacturer use	0	$78	Numerator of external scale ratio	0
$39	For manufacturer use	0	$79	Multiplier of numerator of external scale ratio	0
$3A	For manufacturer use	0	$7A	Denominator of external scale ratio	10000
$3B	For manufacturer use	0	$7B	Hybrid deviation error level	100
$3C	For manufacturer use	0	$7C	External scale direction	0
$3D	JOG speed	300	$7D	Absolute external scale setup	0
$3E	For manufacturer use	0	$7E	For manufacturer use	0
$3F	For manufacturer use	0	$7F	For manufacturer use	0

In this example, we will write to the emergency stop enable parameter:

```
M8182=$41
```

5. If writing to a parameter, set PARAM_DATA (M8183) equal to the desired value, but if you are reading from drive or saving the values to EEPROM of the drive set PARAM_NUM equal to zero.

```
M8183=$0
```

6. Set the PMC_STATE (M8123) equal to 6 (Parameter Read Mode).

```
M8123=6
```

7. Wait until PMC_STATE (M8123) changes to 4 (Running Mode).
8. If you are reading a parameter, you can get the value from PARAM_DATA (M8183). Otherwise, the writing or saving is done.

Accessing Returning Data from A4N/A5N Drives

The communication to each drive is taking place using two buffers, the TX buffer and RX buffer. These buffers are accessible to the user and some useful information can be retrieved from these buffers. Although reading these buffers is harmless to the performance and functionality of the Realtime Express network and controller, we would strongly discourage writing to these locations.

The received data from each drive consists of 16 bytes. These 16 bytes are transferred to PMAC through Dual-Ported RAM style memory mapping, meaning lower 16 bits of X and Y memory locations.

	X-Memory		Y-Memory	
$680XX	Byte 3	Byte 2	Byte 1	Byte 0
$680XX+1	Byte 7	Byte 6	Byte 5	Byte 4
$680XX+2	Byte 11	Byte 10	Byte 9	Byte 8
$680XX+3	Byte 15	Byte 14	Byte 13	Byte 12

The $680XX represents the memory location for different RX block numbers. The block number of each motor is defined by the user by setting the Ixx30 of each motor. If the default values in the PANADWLD.PMC file are used, the block 0 represents motor 1, block 1 represent motor 2 and so on.

Block No.	0	1	2	3	4	5	6	7
Memory Address	$68080	$68084	$68088	$6808C	$68090	$68094	$68098	$6809C
Block No.	8	9	10	11	12	13	14	15
Memory Address	$680A0	$680A4	$680A8	$680AC	$680B0	$680B4	$680B8	$680BC
Block No.	16	17	18	19	20	21	22	23
Memory Address	$680C0	$680C4	$680C8	$680CC	$680D0	$680D4	$680D8	$680DC
Block No.	24	25	26	27	28	29	30	31
Memory Address	$680E0	$680E4	$680E8	$680EC	$680F0	$680F4	$680F8	$680FC

The first four bytes of data for each RX block includes various status bits:

<table>
<tr><th>Address</th><th>Bits</th><th>Name</th><th>Description</th></tr>
<tr><td rowspan="3">Y:$680XX</td><td>0~4</td><td>Actual MAC-ID</td><td>Returns the node address of the servo drive.
This is not echo-back, but actual value that is the setup of the RSW at power-up.</td></tr>
<tr><td>5~6</td><td>Update Counter</td><td>Returns the echo-back value of Update Counter.
Use this to check whether the drive has received properly.</td></tr>
<tr><td>7</td><td>C/R</td><td>C/R bit distinguish Command and Response.
Returns 1 as a response.</td></tr>
<tr><td>Y:$680XX</td><td>8~14</td><td>Command Code Echo</td><td>Returns the echo-back value of Command Code.</td></tr>
<tr><td rowspan="8">X:$680XX</td><td>15</td><td>CMD Error</td><td>Returns 1 at the command error.</td></tr>
<tr><td>0</td><td>In Position</td><td>Returns 1 at Positioning operation completed (In-position status)
Set up the condition by Pr.63 “In-position output set up”.</td></tr>
<tr><td>2</td><td>Homing Complete</td><td>Returns 1 at Homing operation completed and holds 1 after that.
Clears to 0 at reception of Homing command.
Returns 1 from the power-up when you use the absolute encoder in absolute mode at Position control mode or when you use the absolute external scale in absolute mode at Full-closed control mode.</td></tr>
<tr><td>3</td><td>Torque Limited</td><td>Returns 1 at torque limited.</td></tr>
<tr><td>4</td><td>Warning</td><td>Returns 1 at warning occurrence.</td></tr>
<tr><td>5</td><td>Alarm</td><td>Returns 1 at alarm occurrence.</td></tr>
<tr><td>6</td><td>Servo Ready</td><td>Returns 1 at Servo-Ready (Transition-able to Servo-ON) state.
Becomes 1 when all of the 3 conditions are satisfied, “Main power established”, “No alarm occurrence” and “Synchronization between the servo and the communication established”
(Note) The servo drive might not become Servo-Ready state if the Update Counter is not counted up properly.</td></tr>
<tr><td>7</td><td>Servo Active</td><td>Returns 1 at Servo-ON state.</td></tr>
<tr><td>8,9,10</td><td>Home,
CCWL/CWL,
CWL/CCWL</td><td>Returns 1 when the sensor signal is active.
<table>
<tr><td>CCWL/CWL,
CWL/CCWL</td><td>Active when Input photo-coupler is OFF
(Note) Returns the signal status even if Pr.04 “Over-travel input inhibit” is 1 (inhibit).</td></tr>
<tr><td>HOME</td><td>Depends on Pr.42 “Home input logic”.</td></tr>
</table>
The bit1/bit0 allocation for CCWL and CWL depend on the value of Pr.43 “Direction of motion”.
<table>
<tr><td rowspan="2">Pr.43</td><td colspan="2">Byte3 at Response</td></tr>
<tr><td>Bit1</td><td>Bit 0</td></tr>
<tr><td>0, 1</td><td>CCWL</td><td>CWL</td></tr>
<tr><td>2, 3</td><td>CWL</td><td>CCWL</td></tr>
</table></td></tr>
<tr><td>11</td><td>EX-IN1</td><td rowspan="4">Returns 1 (at bit corresponding to each input) when External input is ON (Input photo-coupler ON).
You can use EX-IN4 as EX-SON (External Servo-ON input） when Pr.40 “External servo-on enable” is 1.</td></tr>
<tr><td>12</td><td>EX-IN2</td></tr>
<tr><td>13</td><td>EX-IN3</td></tr>
<tr><td>14</td><td>EX-IN4/EX-SON</td></tr>
<tr><td>15</td><td>EMG-STP</td><td>Returns 1 when Emergency-Stop input (EMG-STP) is ON (Input photo-coupler OFF).
Returns the signal status even if Pr.41 "Emergency stop enable” is 0 (disable).</td></tr>
</table>

Using Absolute Feedback With A4N/A5N Drives

If you have Panasonic motors with absolute feedback, you need to set up the drive in order to use this feature. Here are the steps that you need to follow:

As an example, we will assume motor 1 has the absolute encoder. By default, the drives are set to incremental mode. So we need to change the mode to absolute encoders by changing the drive's parameter $0B to a value of $0.

```
M8180=1             // motor #1
M8181=$1            // write to parameter
M8182=$0B           // parameter number
M8183=$0            // value
M8123=6             // execute the parameter read/write
```

Once the parameter is changed, save the data in the EEPROM of the device:

```
M8180=1             // motor #1
M8181=$101          // write to EEPROM
M8182=$0            // parameter number must be 0 for writing to EEPROM
M8183=$0            // value must be 0 for writing to EEPROM
M8123=6             // execute the parameter read/write
```

Once you have made this change on the drive, cycle the power off and on for the drive. For safety reasons, the Panasonic drive will show error 40 representing absolute encoder system down error. In order to clear this fault, first we have to clear the absolute encoder's multi-turn data.

```
I133=$31            // Multi-turn data clear in absolute encoder (homing mode)
I124=$120000        // set bit 20 to high in order to ignore the error 40 or else the next
                    // command will be ignored
#1hm
I124=$820000        // set bit 20 back to zero and bit 23 to 1 indicating A4N/A5N
                    // drives high true amp-fault
```

Now that the multi-turn data is cleared, we can clear the fault from the drive.

```
M8123=5
```

Since Ixx10 and Ixx95 are set up properly in the original PANADWLD.PMC file, the absolute information will be read automatically on power-up or $$$ command. If you want to command an absolute data read manually, you can use the $* command.

```
#1$*
```

Detecting Errors on A4N/A5N Network

PMC_ERROR_FLAG (M8130) holds the detected errors on the network in the following format:

Bits	Partial Element
[3:0]	STATE_RING_CONFIG
[7:4]	STATE_READY
[11:8]	STATE_START
[15:12]	STATE_RUNNING
[20:16]	Source Motor Number for Error

The following error codes are possible in each of the elements above

Error Code	Error Description
0	No Error
1	ERR_TIMEOUT
2	ERR_NODE_SUM
4	ERR_NODE_BLK
8	ERR_MACID
9	ERR_FLAG2
A	ERR_I59
B	ERR_CRC_PER
C	ERR_E_STOP

To clear the fault from the drive/network, M8123=5 command can be used.

```
M8123=5
```