USER MANUAL

Accessory 57E

Yaskawa & Mitsubishi Abs. Enc. Con. Board

3Ax-603484-xUxx

November 16, 2007

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REVISION HISTORY				
REV.	DESCRIPTION	DATE	CHG	APPVD
1	ADDED ACC-57E DB15 CONNECTOR OPTION P. 28-29	11/16/07	CP	S. MILICI

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INTRODUCTION

UMAC's Acc-57E allows a UMAC interface to the Yaskawa or Mitsubishi absolute encoder. The Acc-57E is part of the UMAC or MACRO Pack family of expansion cards and these accessory cards are designed to plug into an industrial 3U rack system. The information from these accessories is passed directly to either the UMAC or MACRO Station CPU via the high speed JEXP expansion bus. Other axis or feedback interface JEXP accessories include the following:

- Acc-14E Parallel Feedback Inputs (absolute enc. or interferometers)
- Acc-24E2 Digital Amplifier Breakout with TTL encoder inputs or MLDT
- Acc-24E2A Analog Amplifier Breakout with TTL encoder inputs or MLDT
- Acc-24E2S Stepper Amplifier Breakout with TTL encoder inputs or MLDT
- Acc-28E 16-bit A/D Converter Inputs (up to four per card)
- Acc-51E 4096 times interpolator for 1Vpp sinusoidal encoders
- Acc-53E SSI encoder interface (up to eight channels)

Up to eight Acc-57E boards can be connected to one UMAC providing up to 32 channels of encoder feedback. Because each MACRO Station CPU can only service eight channels of servo data, only two fully populated Acc-57E boards can be connected to the MACRO-Station.

This board provides up to four channels of absolute encoder inputs to the UMAC controller with both A/B quadrature incremental encoder signal feedback as well as absolute position data. To prevent data from being lost in the case of power loss or power off conditions, a 3.3V battery is included on the board with a monitor circuit to provide an indication of any drop in excess of 5%. In addition, there are four jumpers on the board to allow the customer to reset the absolute position value. See the related paragraphs below for a detailed description of the absolute encoder setup.

Options

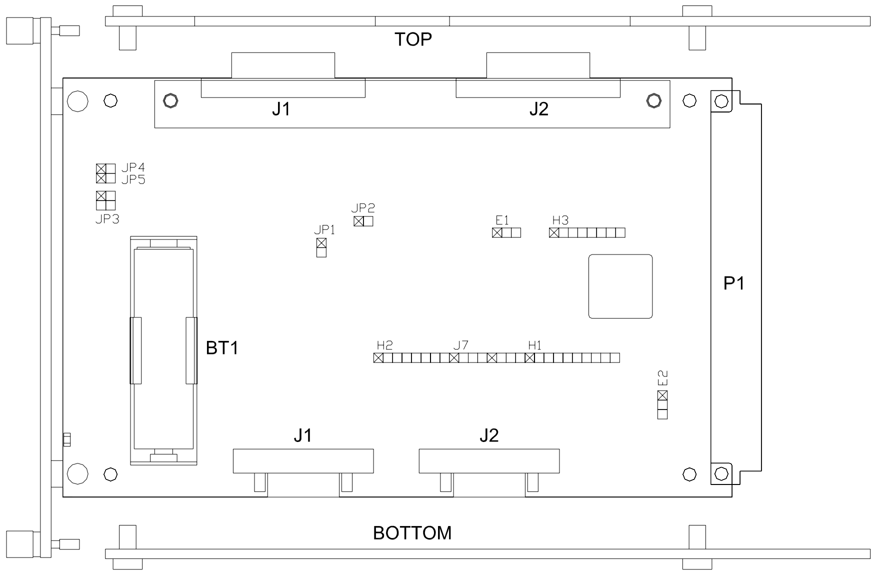
Acc- 57E(Basic card)	Two axes Yaskawa absolute encoder interface
Acc-57E option Y	Additional two-axes Yaskawa absolute encoder interface (additional card must be ordered with the basic card).
Acc-57E option M	Eight axes Mitsubishi absolute encoder interface Mitsubishi Option can only be used with the MR-J25-xA series drive.

Note:

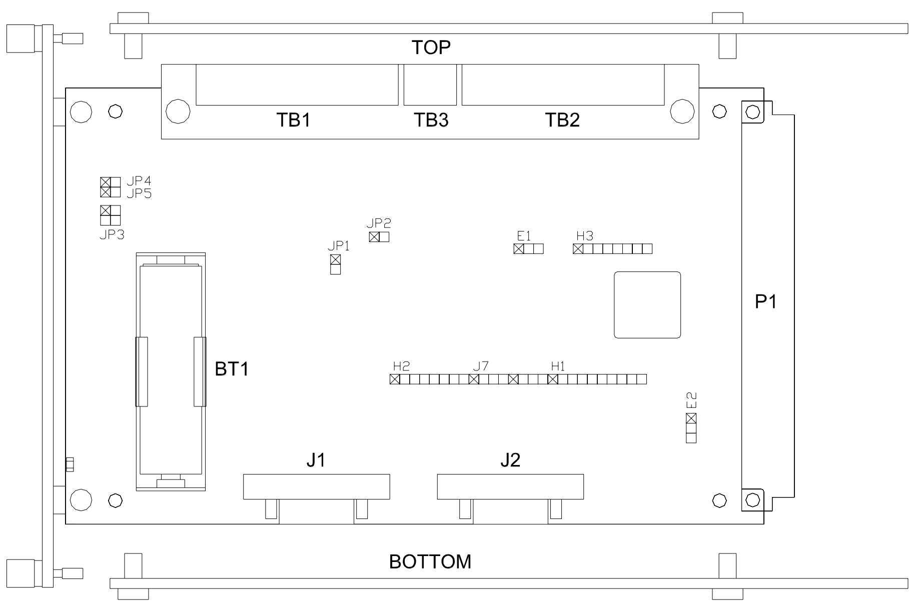
The Acc-57E Option M cannot be combined with option Y, and vice versa. In order to avoid the confusion between these two different encoder user, this manual will be divided into two parts-Part I will be the manual for Yaskawa absolute encoder user, Part II is for the Mitsubishi absolute encoder user.

BOARD LAYOUT

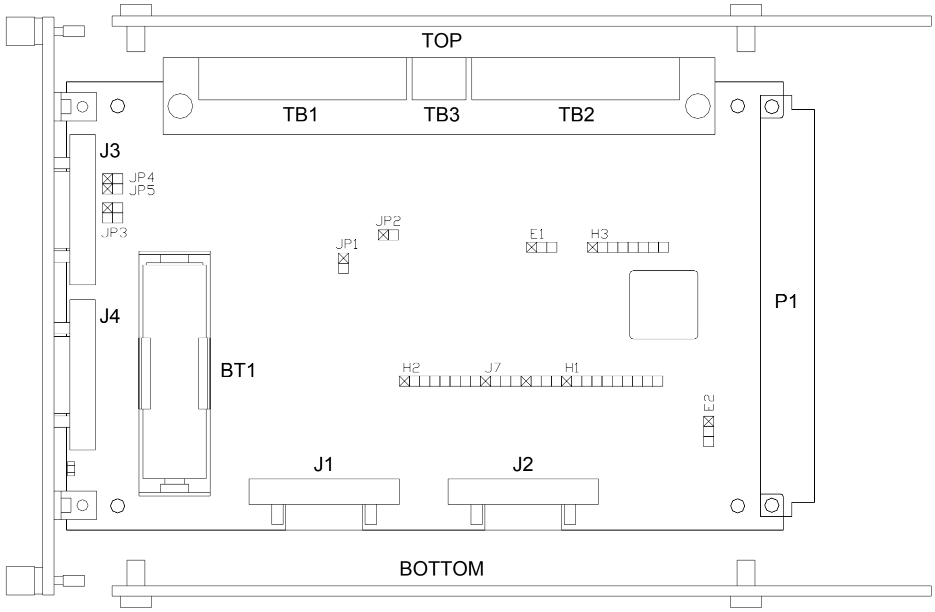
Acc-57E - Yaskawa DB15 Option



Acc-57E - Yaskawa Terminal Block Option



Acc-57E - Mitsubishi Terminal Block Option



HARDWARE SETTINGS

The Acc-57 uses expansion port memory locations defined by the type of PMAC (3U Turbo or MACRO Station) it is directly communicating to. Typically, these memory locations are used with other Delta Tau 3U I/O accessories such as:

- Acc-9E 48 optically isolated inputs
- Acc-10E 48 optically isolated outputs, low power
- Acc-11E 24 inputs and 24 outputs, low power, all optically isolated
- Acc-12E 24 inputs and 24 outputs, high power, all optically isolated
- Acc-14E 48-bits TTL level I/O
- Acc-28E 16-bit A/D Converter Inputs (up to four per card)

All of these accessories have settings which tell them where the information is to be processed at either the PMAC 3U Turbo or the MACRO Station.

3U Turbo PMAC Memory Locations	MACRO Station Memory Locations
\$078C00, \$079C00 \$07AC00, \$07BC00	\$8800,\$9800 \$A800,\$B800
\$078D00, \$079D00 \$07AD00, \$07BD00	\$8840,\$9840 \$A840,\$B840
\$078E00, \$079E00 \$07AE00, \$07EC00	\$8880,\$9880 \$A880,\$B880
\$078F00, \$079F00 \$07AF00, \$07BF00	\$88C0,\$98C0 \$A8C0,\$B8C0

The Acc-53E has a set of dipswitches telling it where to write the information form the absolute encoders. Once the information is at these locations, we can process the binary word in the encoder conversion table to use for servo loop closure. Proper setting of the dipswitches ensures all of the JEXP boards used in the application do not interfere with each other.

Address Select DIP Switch S2

The switch two (S2) settings will allow the user to select the starting address location for the first encoder. Encoders two through eight will follow in descending order from the address selected by the S2 switch. The following two tables show the dip switch settings for both the Turbo PMAC 3U and the MACRO Station.

Turbo PMAC 3U Switch Settings

Chip Select	3U Turbo PMAC Address	Dip Switch SW1 Position					
		6	5	4	3	2	1
CS10	Y:$78C00-03	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
	Y:$79C00-03	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	CLOSE
	Y:$7AC00-03	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	CLOSE
	Y:$7BC00-03	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE
CS12	Y:$78D00-03	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN
	Y:$79D00-03	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	OPEN
	Y:$7AD00-03	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	OPEN
	Y:$7BD00-03	CLOSE	CLOSE	OPEN	OPEN	CLOSE	OPEN
CS14	Y:$78E00-03	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	CLOSE
	Y:$79E00-03	CLOSE	CLOSE	CLOSE	OPEN	OPEN	CLOSE
	Y:$7AE00-03	CLOSE	CLOSE	OPEN	CLOSE	OPEN	CLOSE
	Y:$7BE00-03	CLOSE	CLOSE	OPEN	OPEN	OPEN	CLOSE
CS16	Y:$78F00-03	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN
	Y:$79F00-03	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN
	Y:$7AF00-03	CLOSE	CLOSE	OPEN	CLOSE	OPEN	OPEN
	Y:$7BF00-03	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN

CLOSE refers to the ON position of the switch and OPEN refers to the OFF position on the switch.

MACRO Station Switch Settings

Chip Select	3U Turbo PMAC Address	Dip Switch SW1 Position					
		6	5	4	3	2	1
CS10	Y:$8800	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE
	Y:$9800	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	CLOSE
	Y:$A800	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	CLOSE
	Y:$B800 ($FFE0*)	CLOSE	CLOSE	OPEN	OPEN	CLOSE	CLOSE
CS12	Y:$8840	CLOSE	CLOSE	CLOSE	CLOSE	CLOSE	OPEN
	Y:$9840	CLOSE	CLOSE	CLOSE	OPEN	CLOSE	OPEN
	Y:$A840	CLOSE	CLOSE	OPEN	CLOSE	CLOSE	OPEN
	Y:$B840 ($FFE8*)	CLOSE	CLOSE	OPEN	OPEN	CLOSE	OPEN
CS14	Y:$8880	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	CLOSE
	Y:$9880	CLOSE	CLOSE	CLOSE	OPEN	OPEN	CLOSE
	Y:$A880	CLOSE	CLOSE	OPEN	CLOSE	OPEN	CLOSE
	Y:$B880 ($FFF0*)	CLOSE	CLOSE	OPEN	OPEN	OPEN	CLOSE
CS16	Y:$88C0	CLOSE	CLOSE	CLOSE	CLOSE	OPEN	OPEN
	Y:$98C0	CLOSE	CLOSE	CLOSE	OPEN	OPEN	OPEN
	Y:$A8C0	CLOSE	CLOSE	OPEN	CLOSE	OPEN	OPEN
	Y:$B8C0	CLOSE	CLOSE	OPEN	OPEN	OPEN	OPEN

The default setting is All Closed position.

For Option 1 (extra four channels), the next four channels of the encoder data will be added on sequentially (04-07).

JUMPERS

Refer to the layout diagram of Acc-57E for the location of the jumpers on the board.

E-Point Jumpers

Jumper	Config	Description	Default
E1	1-2-3	1-2 for bootstrap 2-3 for single chip mode	2-3
E2	1-2-3	Jump 1-2 for Turbo 3U CPU and MACRO CPU * Jump 2-3 for legacy MACRO CPU (before 6/00)	1-2
* For legacy MACRO Stations (part number 602804-100 thru 602804-104)			

JP- Jumpers

Jumper	Config	Description	Default
JP1	1-2	1-2 for Option M Mitsubishi RS232 mode. No jumper for Option M Mitsubishi RS422 mode	No jumper
JP2	1-2	1-2 for CPU reset. No jumper for normal operation	No Jumper
JP3	1-2	1-2 for Option M Mitsubishi RS232 mode. No jumper for Option M Mitsubishi RS422 mode	No jumper
JP4	1-2	1-2 for Mitsubishi absolute encoder 1/F. No jumper for Yaskawa absolute encoder 1/F	No Jumper

Connector Descriptions

TB1 and TB2

These are 12 position terminal blocks; they are designed to take the Yaskawa absolute encoder signals as an input to the interface card, TB1 for encoder 1, and TB2 for encoder 2 respectively.

They are used to connect to Yaskawa absolute encoder-for both absolute data signals and the incremental pulses. These terminal blocks have the same pin-out as Acc-24E2. In order to share the incremental pulse signal with Acc-24E2, a physical cable connection has to be installed by the customer.

J1 and J2

These 20 pin D-Sub connectors provide the direct connection for the Yaskawa Servo Pack user. The pin-outs on these connectors are the same as 2CN on the Servo Pack, please reference the Yaskawa Servo Pack User Manual for details.

J3 and J4

These two 20 pin D-sub connectors allow direct connection from the RS422 communications cable between the Mitsubishi drive and Acc-57E Option M card.

Up to 8 Mitsubishi drives can be connected on this card. If there are only two drives involved in the system, these two connectors can be used to connect the two drives respectively, for more than two drives system, a special daisy chained cable has to build by customer (will mention in the system wiring section).

J6

Reserved for factor test use only.

J7

Lattice CPLD program connector for factory use only.

P1

UMAC Bus back-plane connector.

Hardware Address Limitations

Some of the older UMAC IO accessories might create a hardware address limitation relative to the newer series of UMAC high-speed IO cards. The Acc-57E would be considered a newer high speed IO card. The new IO cards have four addresses per chip select (CS10, CS12, CS14, and CS16). This enables these cards to have up to 16 different addresses. The Acc-9E, Acc-10E, Acc-11E, and Acc-12E all have one address per chip select but also have the low-byte, middle-byte, and high-byte type of addressing scheme and allows for a maximum of twelve of these IO cards.

UMAC Card Types

UMAC Card	Number of Addresses	Category	Maximum # of cards	Card Type
Acc-9E, Acc-10E Acc-11E, Acc-12E	4	General IO	12	A
Acc-65E, Acc-66E Acc-67E, Acc-68E Acc-14E	16	General IO	16	B
Acc-28E, Acc-36E Acc-59E	16	ADC and DAC	16	B
Acc-53E, Acc-57E Acc-58E	16	Feedback Devices	16	B

Chip Select Addresses

Chip Select	UMAC Turbo Type A Card	MACRO Type A Card	UMAC Turbo Type B Card	MACRO Type B Card
10	$078C00	$FFE0 or $8800	$078C00, $079C00 $07AC00, $07BC00	$8800,$9800 $A800,$B800
12	$078D00	$FFE8 or $8840	$078D00, $079D00 $07AD00, $07BD00	$8840,$9840 $A840,$B840
14	$078E00	$FFF0 or $8880	$078E00, $079E00 $07AE00, $07EC00	$8880,$9880 $A880,$B880
16	$078F00	$88C0	$078F00, $079F00 $07AF00, $07BF00	$88C0,$98C0 $A8C0,$B8C0

Addressing Conflicts

When using only the type A UMAC cards or using only the type B UMAC cards in an application, do not worry about potential addressing conflicts other than making sure the individual cards are set to the addresses as specified in the manual.

If using both type A and type B UMAC cards in their rack, be aware of the possible addressing conflicts. If using the Type A card on a particular Chip Select (CS10, CS12, CS14, or CS16), then do not use a Type B card with the same Chip Select address unless the Type B card is a general IO type. If the Type B card is a general IO type, then the Type B card will be the low-byte card at the Chip Select address and the Type A cards will be setup at as the middle-byte and high-byte addresses.

Type A and Type B Example 1: Acc-11E and Acc-57E

If using an Acc-11E and Acc-57E, do not allow both cards to use the same Chip Select because the data from both cards will be overwritten by the other card.

The solution to this problem is to make sure both cards are not addressed to the same chip select.

Type A and Type B Example 2: Acc-11E and Acc-65E

For this example, allow the two cards to share the same chip select because the Acc-65E is a general purpose IO Type B card. The only restriction in doing so is that the Acc-65E must be considered the low-byte addressed card and the Acc-11E must be jumpered to either the middle or high bytes (jumper E6A-E6H).

ACC-57E THEORY OF OPERATION

The encoder absolute position data for the motor is processed at the Acc-57E while the on-going encoder position is processed at the Acc-24E2 card like a standard encoder. The Acc-57E will request the absolute data from the encoder and process this data as parallel word. Since the Yaskawa absolute encoders and Mitsubishi Drives have standard quadrature encoders outputs, wire these signals to a standard Acc-24E2, Acc-24E2A, or Acc-24E2S cards to obtain the on-going position data for PMAC.

To read the absolute data, setup PMAC variables Ixx10 and Ixx95. Once these parameters are setup correctly, the absolute data can be obtained at either power-up, software restart (**$$$** command) or with the online motor specific restart command **#n$*** where n stands for the motor number.

For both the UMAC Turbo and the Turbo UMAC MACRO systems, Ixx10 will be setup to tell the controller where the absolute data resides and Ixx95 tells the controller how to process the absolute data. For non-Turbo UMAC MACRO systems Ix10 is used to tell the controller where the absolute data resides and how to process the data.

For the Yaskawa Encoder, Ixx98 and Ixx99 must also be setup at the UMAC Turbo to process the data from Ixx10 and Ixx95. On non-Turbo Ultralite/MACRO systems, I8x and I9x must also be setup in conjunction with Ix10.

UMAC TURBO I-VARIABLE SETUP FOR POWER ON POSITION

Ixx10 – Motor xx Power-On Position Address

Ixx10 should be set to the location associated with the switch setting of the Acc-57E. The following table shows the possible address settings of Ixx10.

Base Address	Channel 1	Channel 2	Channel 3	Channel 4
Y:$78C00	Y:$78C00	Y:$78C01	Y:$78C02	Y:$78C03
Y:$79C00	Y:$79C00	Y:$79C01	Y:$79C02	Y:$79C03
Y:$7AC00	Y:$7AC00	Y:$7AC01	Y:$7AC02	Y:$7AC03
Y:$7BC00	Y:$7BC00	Y:$7BC01	Y:$7BC02	Y:$7BC03
Y:$78D00	Y:$78D00	Y:$78D01	Y:$78D02	Y:$78D03
Y:$79D00	Y:$79D00	Y:$79D01	Y:$79D02	Y:$79D03
Y:$7AD00	Y:$7AD00	Y:$7AD01	Y:$7AD02	Y:$7AD03
Y:$7BD00	Y:$7BD00	Y:$7BD01	Y:$7BD02	Y:$7BD03
Y:$78E00	Y:$78E00	Y:$78E01	Y:$78E02	Y:$78E03
Y:$79E00	Y:$79E00	Y:$79E01	Y:$79E02	Y:$79E03
Y:$7AE00	Y:$7AE00	Y:$7AE01	Y:$7AE02	Y:$7AE03
Y:$7BE00	Y:$7BE00	Y:$7BE01	Y:$7BE02	Y:$7BE03
Y:$78F00	Y:$78F00	Y:$78F01	Y:$78F02	Y:$78F03
Y:$79F00	Y:$79F00	Y:$79F01	Y:$79F02	Y:$79F03
Y:$7AF00	Y:$7AF00	Y:$7AF01	Y:$7AF02	Y:$7AF03
Y:$7BF00	Y:$7BF00	Y:$7BF01	Y:$7BF02	Y:$7BF03

Ixx95 - Motor xx Power-On Servo Position Format

Ixx95 will be set to a value which tells the controller that the register from Ixx10 will be processed as an Acc-57E absolute encoder. The following table shows the possible settings of Ixx95.

Encoder Type	Controller	Ixx95 Value
Yaskawa	UMAC Turbo	$988008
Yaskawa	UMAC MACRO	$720000 – unsigned $F20000 – signed
Mitsubishi	UMAC Turbo	$200008 – unsigned $A00008 - signed
Mitsubishi	UMAC MACRO	$720000 – unsigned $F20000 – signed

Ixx98 - Motor xx Resolver Third Gear Ratio (Yaskawa Only) for Turbo

Ixx98 tells the PMAC how many counts per revolution the Yaskawa Encoder has. The units for this parameter are in counts per revolution divided by 4096. The counts per revolution are based on the decode value of I7mn0. Usually, 4× decode is used.

If the Yaskawa absolute encoder being used has 32768 counts per revolution, then set Ixx10 to the following value:

$$Ixx98 = \frac{32768}{4096} = 8$$

Note

Changing the sign of the calculated value changes the sense of the absolute feedback data.

Ixx99 - Motor xx Second Resolver Gear Ratio (Yaskawa Encoder only) for Turbo

This is used to let the PMAC know what the remainder from the Ixx98 division is. For most Yaskawa encoders, this value will be zero because the majority of their encoders are based on a power of two line count (1024, 2048, 4096, etc.).

Example: The number of lines per revolution of the Yaskawa absolute encoder in the system is 8192. PMAC will multiply this term by 4 and read (8192×4) = 32768 counts/rev.

$$\therefore \quad Ixx98 = \frac{32768}{4096} = 8$$

$$Ixx99 = 0$$

I8x - Motor xx Resolver Third Gear Ratio (Yaskawa only) for non-Turbo

I8x tells the PMAC how many counts per revolution the Yaskawa Encoder has. The units for this parameter are in counts per revolution divided by 4096. The counts per revolution are based on the decode value of I7mn0. Usually, 4× decode is used.

If the Yaskawa absolute encoder you are using has 32768 counts per revolution, then the user will set Ixx10 to the following value:

$$I8x = \frac{32768}{4096} = 8$$

I9x- Motor xx Second Resolver Gear Ratio (Yaskawa Encoder only) for non-Turbo

This is used to let the PMAC know what the remainder from the I9x division is. For most Yaskawa encoders, this value will be zero because the majority of their encoders are based on a power of a two line count (1024, 2048, 4096, etc.).

Example: The number of lines per revolution of the Yaskawa absolute encoder in the system is 8192. PMAC will multiply this term by 4 and read (8192×4) = 32768 counts/rev.

$$\therefore \quad I8x = \frac{32768}{4096} = 8$$

$$I9x = 0$$

Example: Turbo UMAC Yaskawa Absolute Encoder Setup

For this example, the Acc-57E is addressed to the base address Y:$78D00 based on the SW1 settings. The four encoders for this example have 8192 lines per revolution or 32768 encoder counts (with 4× decode). Also assume that we are setting up motors 1, 2, 3, and 4. To properly setup the Acc-57E to read Yaskawa absolute encoders, do the following:

Ixx10 Setup

```
I110=$78D00                    ; first channel Acc-57E
I210=$78D01                    ; second channel Acc-57E
I310=$78D02                    ; third channel Acc-57E
I410=$78D03                    ; fourth channel Acc-57E
```

Ixx95 Setup

```
I195=$988008                   ;Yaskawa absolute power on position setting
I295=$988008                   ;Yaskawa absolute power on position setting
I395=$988008                   ;Yaskawa absolute power on position setting
I495=$988008                   ;Yaskawa absolute power on position setting
```

Ixx98 Setup

```
I198=8                         ; Ixx98 = 32768/4096 = 8
I298=8                         ; Ixx98 = 32768/4096 = 8
I398=8                         ; Ixx98 = 32768/4096 = 8
I498=8                         ; Ixx98 = 32768/4096 = 8
```

Ixx99 Setup

```
I199=0                         ; Ixx99 =  remainder from Ix98 calculation
I299=0                         ; Ixx99 =  remainder from Ix98 calculation
I399=0                         ; Ixx99 =  remainder from Ix98 calculation
I499=0                         ; Ixx99 =  remainder from Ix98 calculation
```

Example: Turbo UMAC Mitsubishi Absolute Encoder Setup

For this example, the Acc-57E will be addressed to the base address Y:$78D00 based on the SW1 settings. We will also assume that we are setting up motors 1, 2, 3, and 4 as signed absolute encoders. To properly setup the Acc-57E to read Mitsubishi absolute encoders, do the following:

Ixx10 Setup

```
I110=$78D00                    ; first channel Acc-57E
I210=$78D01                    ; second channel Acc-57E
I310=$78D02                    ; third channel Acc-57E
I410=$78D03                    ; fourth channel Acc-57E
```

Ixx95 Setup

```
I195=$A00008             ;Mitsubishi absolute power on position setting (signed)
I295=$A00008             ;Mitsubishi absolute power on position setting (signed)
I395=$A00008             ;Mitsubishi absolute power on position setting (signed)
I495=$A00008             ;Mitsubishi absolute power on position setting (signed)
```

POWER ON PHASING WITH ACC-57E

All brushless motors require some type of a phase-search on power up to establish a relationship between the zero position of the motor's commutation cycle and the zero position of the feedback device. Since the data from the Acc-57E is absolute, the motor phase position relative encoder position is fixed and a no-movement motor phase can be performed. To properly phase the motor using the absolute data from the Acc-57E, set up I-variables Ixx81, Ixx91 (for Turbo only), Ixx75, and Ixx80.

The no-movement power-on phase reference works as follows. Initially, when setting up the system (this may be done in a lab setting) the motor is forced to the zero position in its phase cycle. The position of the absolute sensor is read by querying an M-variable previously set up to point to the sensor. After performing some math on this value, the resulting value is stored in PMAC as Ix75 and represents the power-on phase position offset. Ix81 is set to tell PMAC the address location where it can find the absolute sensor's feedback and how to decode this information. On power-up (or when a reset motor, **"$"**, command is issued) PMAC will look to this address, grab the current position of the rotor, add to it the pre-determined offset parameter, and instantly it knows where the motor is in its phasing cycle relevant to the current position! No movement is necessary.

Ixx81

Ixx81 tells Turbo PMAC what address to read for absolute power-on phase-position information for Motor xx, if such information is present. This can be a different address from that of the ongoing phase position information, which is specified by Ixx83, but it must have the same resolution and direction sense. Ixx81 is set to zero if no special power-on phase position reading is desired, as is the case for an incremental encoder.

Ixx91

Ixx91 tells how the data at the address specified by Ixx81 is to be interpreted. It also determines whether the location specified by Ixx81 is a multiplexer (thumbwheel) port address, an address in Turbo PMAC's own memory and I/O space, or a MACRO node number.

Ixx75

Ixx75 tells Turbo PMAC the distance between the zero position of an absolute sensor used for power-on phase position (specified by Ixx81 and Ixx91) and the zero position of Turbo PMAC's commutation cycle. It is used to reference the phasing algorithm for a PMAC-commutated motor with an absolute sensor (Ixx81 > 0). See the Software Reference manual for the proper setting.

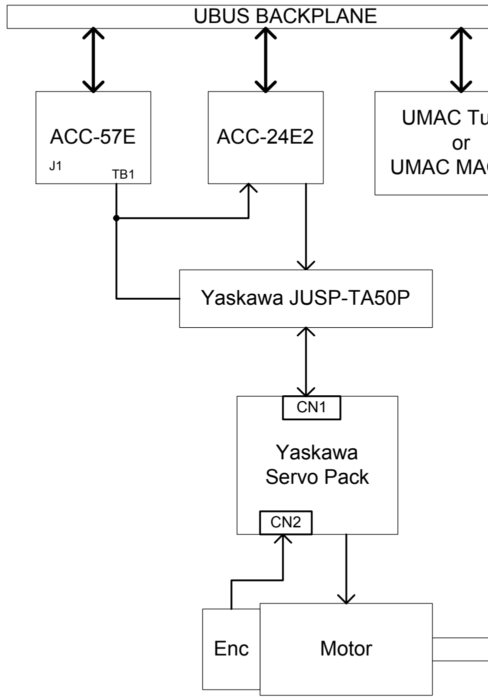
Ixx80

Ixx80 controls the power-up mode, including the phasing search method (if used), for Motor xx. If Ixx80 bit 0 is 1 (Ixx80 = 1 or 3), this is done automatically during the power-up/ reset cycle and it also be done in response to a **$** on-line command to the motor, or a **$$** on-line command to the coordinate system containing the motor. If Ixx80 is set to 0, phasing will also be done in response to a **$** on-line command to the motor, or a **$$** on-line command to the coordinate system containing the motor.

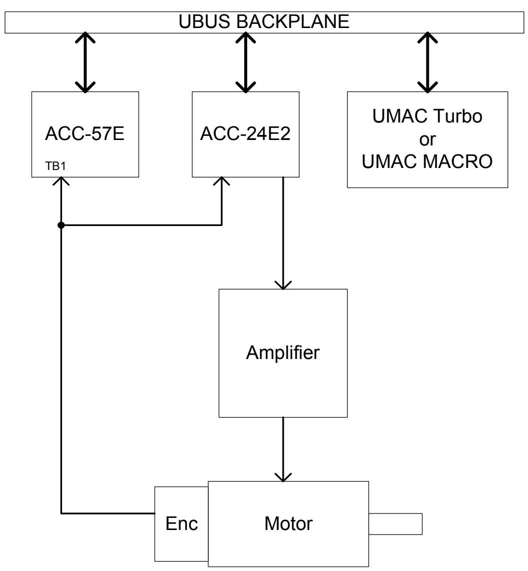
Encoder	Controller	Ixx81	Ixx91
Yaskawa	UMAC Turbo	Servo IC Address	$180000
Yaskawa	Turbo Ultralite	MACRO IC Address	$180000
Mitsubishi	UMAC Turbo	Servo IC Address	$100008
Mitsubishi	Turbo Ultralite	MACRO IC Address	$150000

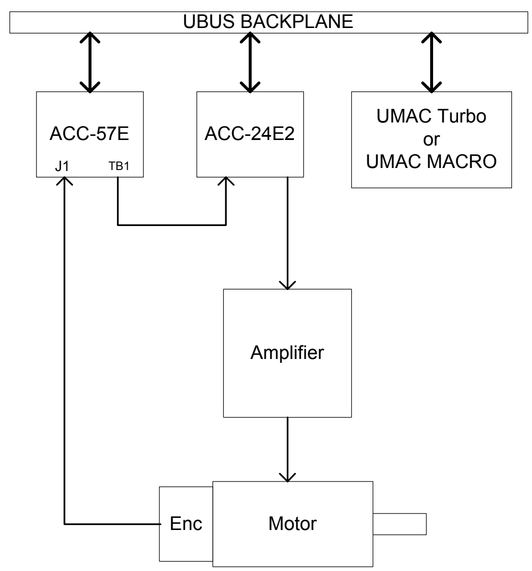
ACC-57E CONFIGURATION BLOCK DIAGRAMS

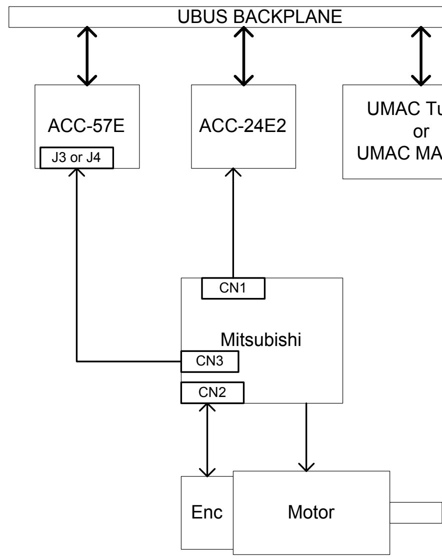
Yaskawa Servo Pack Diagram



Yaskawa Generic Absolute Encoder Setup Mitsubishi Absolute Encoder Setup






UBUS BACKPLANE
ACC-57E
J3 or J4
ACC-24E2
UMAC Turbo
or
UMAC MACRO
CN1
Mitsubishi
CN3
CN2
Enc
Motor

ACC-57E SETUP FOR UMAC MACRO

In order to process the data from the Acc-57E correctly the MACRO Station CPU must have firmware version 1.16 or newer. If using the information from the Acc-57E converter for absolute position servo data, set up variables at both the Ultralite and MACRO station for proper operation. The absolute encoder data from the Acc-57E is processed as a parallel word input at the MACRO Station and then transmitted back to the Ultralite using the power on position servo node MACRO I-variables. In order for the Ultralite controller card to obtain the data, set up the power on position variables at the Ultralite. The on-going position data will be processed as a standard quadrature encoder from the Acc-24E family card.

To obtain the absolute power on position the use must setup MI11x at the MACRO Station and Ixx10 and with the Turbo Ultralite, Ixx95. Regardless of the type of Ultralite, retrieving the power-on-position setup at the MACRO CPU is the same. The information must be retrieved from MACRO Station variable MSn,MI920 for each node transfer as specified by Ixx10 at the Ultralite. Do not set up MSn,MI920, because the MACRO Station will place the power-on position the appropriate register at power-up.

Note:

If MSn,MI920 is monitored, the power on position could be read incorrectly by the Ultralite.

Acc-57E Absolute Encoder Addresses for MACRO

Base Address	Channel 1	Channel 2	Channel 3	Channel 4
Y:$8800	Y:$8800	Y:$8801	Y:$8802	Y:$8803
Y:$9800	Y:$9800	Y:$9801	Y:$9802	Y:$9803
Y:$A880	Y:$A880	Y:$A881	Y:$A882	Y:$A883
Y:$B800	Y:$B800	Y:$B801	Y:$B802	Y:$B803
Y:$8840	Y:$8840	Y:$8841	Y:$8842	Y:$8843
Y:$9840	Y:$9840	Y:$9841	Y:$9842	Y:$9843
Y:$A840	Y:$A840	Y:$A841	Y:$A842	Y:$A843
Y:$B840	Y:$B840	Y:$B841	Y:$B842	Y:$B843
Y:$8880	Y:$8880	Y:$8881	Y:$8882	Y:$8883
Y:$9880	Y:$9880	Y:$9881	Y:$9882	Y:$9883
Y:$A880	Y:$A880	Y:$A881	Y:$A882	Y:$A883
Y:$B880	Y:$B880	Y:$B881	Y:$B882	Y:$B883
Y:$88C0	Y:$88C0	Y:$88C1	Y:$88C2	Y:$88C3
Y:$98C0	Y:$98C0	Y:$98C1	Y:$98C2	Y:$98C3
Y:$A8C0	Y:$A8C0	Y:$A8C1	Y:$A8C2	Y:$A8C3
Y:$B8C0	Y:$B8C0	Y:$B8C1	Y:$B8C2	Y:$B8C3

Power-On Feedback Address for PMAC2 Ultralite

Both the Ultralite and the Turbo Ultralite allow obtaining absolute position at power up or upon request (#n$*). The Ultralite must have Ix10 set up, the Turbo Ultralite needs both Ixx10, and Ixx95 set up to enable this power on position function. For power on position reads as specified in this document MACRO firmware version 1.116 or newer is needed, the Turbo Ultralite firmware must be 1.938 or newer, and lastly the standard Ultralite users must have firmware version 1.17 or newer.

Ix10 permits an automatic read of an absolute position sensor at power-on/reset. If Ix10 is set to 0, the power-on/reset position for the motor will be considered to be 0, regardless of the type of sensor used. There are specific settings of PMAC's/PMAC2's Ix10 for each type of MACRO interface. The Compact MACRO Station has a corresponding variable I11x for each node that must be set.

Absolute Position for Ultralite

Compact MACRO Station Feedback Type (Firmware version 1.17 and above)	Ix10 (Unsigned)	Ix10 (Signed)
Yaskawa Absolute Encoder Converter	$72000n	$F2000n
Mitsubishi Absolute Encoder Converter	$74000n	$F4000n
'n' is the MACRO node number used for Motor x: 0, 1, 4, 5, 8, 9, C(12), or D(13).		

Absolute Position for Turbo Ultralite

(Ixx95=$720000 - $740000, $F20000 - $F40000)

Addresses are MACRO Node Numbers

MACRO Node Number	Ixx10 for MACRO IC 0	Ixx10 for MACRO IC 1	Ixx10 for MACRO IC 2	Ixx10 for MACRO IC 3
0	$000100	$000010	$000020	$000030
1	$000001	$000011	$000021	$000031
4	$000004	$000014	$000024	$000034
5	$000005	$000015	$000025	$000035
8	$000008	$000018	$000028	$000038
9	$000009	$000019	$000029	$000039
12	$00000C	$00001C	$00002C	$00003C
13	$00000D	$00001D	$00002D	$00003D

Compact MACRO Station Feedback Type	Ixx95 (Unsigned)	Ixx95 (Signed)
Yaskawa Absolute Encoder Converter	$720000	$F20000
Mitsubishi Absolute Encoder Converter	$200008	$A00008

When the Ultralite has Ix10 set to get absolute position over MACRO, it executes a station auxiliary read command MS{node},I920 to request the absolute position from the Compact MACRO Station. The station then references its own I11x value to determine the type, format, and address of the data to be read.

MACRO Absolute Position Setup

MI111 through MI118 (MI11*x*) specify whether, where, and how absolute position is to be read on the Compact MACRO Station for a motor node (MI11*x* controls the *x*th motor node, which usually corresponds to Motor *x* on PMAC) and sent back to the Ultralite.

If **MI11*x*** is set to 0, no power-on reset absolute position value will be returned to PMAC. If MI11*x* is set to a value greater than 0, then when the PMAC requests the absolute position because its Ix10 and/or Ix81 values are set to obtain absolute position through MACRO (sending an auxiliary **`MS{node},MI920`** command), the Compact MACRO Station will use MI11*x* to determine how to read the absolute position, and report that position back to PMAC as an auxiliary response.

The following table shows the possible values for MI11*x:*

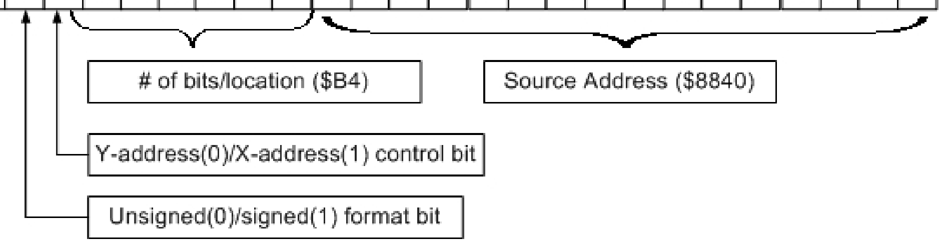
Encoder Type	MI11x Value
Yaskawa	$34[address]
Mitsubishi	$34[address] – unsigned $B4[address] - signed

MI11*x* consists of two parts. The low 16 bits (last four hexadecimal digits) specify the address on the MACRO Station from which the absolute position information is read. The high eight bits (first two hexadecimal digits) tell the Compact MACRO Station how to interpret the data at that address (the method.

MACRO MI11x Parallel Word Example

Signed 24-bit Absolute data from Acc-57E at $8840

Hex ($)	B				4				8				8				4				0			
Bit	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value	1	0	1	1	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0



X/Y Address Bit: If bit 22 of Ix10 is 0, the PMAC looks for the parallel sensor in its Y address space. This is the standard choice, since all I/O ports map into the Y address space. If this bit is 1, PMAC looks for the parallel sensor in its X address space.

Signed/Unsigned Bit: If the most significant bit (MSB -- bit 23) of MI11x is 0, the value read from the absolute sensor is treated as an unsigned quantity. If the MSB is 1, which adds $80 to the high eight bits of MI11x, the value read from the sensor is treated as a signed, two's-complement quantity.

Example: UMAC MACRO Yaskawa Absolute Encoder Setup

For this example, the Acc-57E will be addressed to the base address Y:$8840 based on the SW1 settings. The four encoders for this example have 8192 lines per revolution or 32768 encoder counts (with 4× decode). We will also assume that we are setting up motors 1, 2, 3, and 4. To properly set up the Acc-57E to read Yaskawa absolute encoders, do the following:

MSn,MI11x Setup

```
MS0,MI111=$348840
MS0,MI112=$348841
MS0,MI113=$348842
MS0,MI114=$348843
```

Ixx10 Setup

Axis	Turbo Ultralite Node Address	Ultralite Signed
1	$000100	$F40000
2	$000001	$F40001
3	$000004	$F40004
4	$000005	$F40005

Ixx95 Setup (for Turbo Ultralite)

```
I195=$F20000                ;Yaskawa absolute power on position setting
I295=$F20000                ;Yaskawa absolute power on position setting
I395=$F20000                ;Yaskawa absolute power on position setting
I495=$F20000                ;Yaskawa absolute power on position setting
```

Yaskawa Scale Factor: Ixx98 and Ixx99 for Turbo and I8x and I9x for Non-Turbo

Axis	Turbo Ultralite	Ultralite	Description
1	I198=8	I81=8	32768/4096 = 8
2	I298=8	I82=8	32768/4096 = 8
3	I398=8	I83=8	32768/4096 = 8
4	I498=8	I84=8	32768/4096 = 8

Axis	Turbo Ultralite	Ultralite	Description
1	I199=0	I91=0	Remainder from Ix98 calculation
2	I299=0	I92=0	Remainder from Ix98 calculation
3	I399=0	I93=0	Remainder from Ix98 calculation
4	I499=0	I94=0	Remainder from Ix98 calculation

Example: UMAC MACRO Mitsubishi Absolute Encoder Setup

For this example, the Acc-57E will be addressed to the base address Y:$8840 based on the SW1 settings. We will also assume that we are setting up motors 1, 2, 3, and 4 as signed absolute encoders. To properly set up the Acc-57E to read Mitsubishi absolute encoders, do the following:

MSn,MI11x Setup

```
MS0,MI111=$348840
MS0,MI112=$348841
MS0,MI113=$348842
MS0,MI114=$348843
```

Ixx10 Setup

Axis	Turbo Ultralite Node Address	Ultralite Signed
1	$000100	$F20000
2	$000001	$F20001
3	$000004	$F20004
4	$000005	$F20005

Ixx95 Setup (for Turbo Ultralite)

```
I195=$F20000                  ;Yaskawa absolute power on position setting
I295=$F20000                  ;Yaskawa absolute power on position setting
I395=$F20000                  ;Yaskawa absolute power on position setting
I495=$F20000                  ;Yaskawa absolute power on position setting
```

CONNECTOR PINOUTS

J1 – Yaskawa Sigma Series Encoder Input

Pin #	Symbol	Function	Description	Notes
1	GND	Common	Encoder Common	
2	GND	Common	Encoder Common	
3	GND	Common	Encoder Common	
4	SEN1	Power	+5V	
5	SEN1	Power	+5V	
6	SEN1	Power	+5V	
7	NC			
8	NC			
9	NC			
10	NC			
11	NC			
12	BAT +	Input	+3V	
13	BAT -	Input	Encoder Common	
14	PHC1	Output	Channel C+	
15	*PHC1	Output	Channel C-	1
16	PHA1	Output	Channel A+	
17	*PHA1	Output	Channel A-	
18	PHB1	Output	Channel B+	
19	*PHB1	Output	Channel B-	
20	FGND	Common	Encoder from Ground	

1. Channel C/ is terminated at the connector.
The part number and manufacture information for connector J1and J2 is as follows:
Manufacture: 3M
Part number: N10220-52B2VC

J2 - Yaskawa Sigma Series Encoder Input

Pin #	Symbol	Function	Description	Notes
1	GND	Common	Encoder Common	
2	GND	Common	Encoder Common	
3	GND	Common	Encoder Common	
4	SEN2	Power	+5V	
5	SEN2	Power	+5V	
6	SEN2	Power	+5V	
7	NC			
8	NC			
9	NC			
10	NC			
11	NC			
12	BAT +	Input	+3V	
13	BAT -	Input	Encoder Common	
14	PHC2	Output	Channel C+	
15	*PHC2	Output	Channel C-	1
16	PHA2	Output	Channel A+	
17	*PHA2	Output	Channel A-	
18	PHB2	Output	Channel B+	
19	*PHB2	Output	Channel B-	
20	FGND	Common	Encoder from Ground	

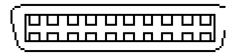
1. Channel C/ is terminated at the connector.

The part number and manufacture information for connector J1and J2 is as follow:

Manufacture: 3M

Part number: N10220-52B2VC

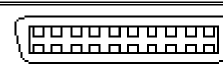
J3 - Mitsubishi RS422 Input



Pin #	Symbol	Function	Description	Notes
1	GND	Common		
2	RXD	Read Input	Serial Data input	
3	NC	No Connection		
4	NC	No Connection		
5	RDP			
6	NC	No Connection		
7	NC	No Connection		
8	NC	No Connection		
9	SDP	No Connection		
10				
11	GND	Common		
12	TXD	Transmit Output	Transmit serial data	
13	NC	No Connection		
14	NC	No Connection		
15	RDN			
16	NC	No Connection		
17	NC	No Connection		
18	NC	No Connection		
19	SDN			
20	NC	No Connection		

The part number and manufacture information for connector J1and J2 is as follow:
Manufacture: 3M
Part number: N10220-52B2VC

J4 – Mitsubishi RS422 Input



Pin #	Symbol	Function	Description	Notes
1	GND	Common		
2	RXD	Read Input	Serial Data input	
3	NC	No Connection		
4	NC	No Connection		
5	RDP			
6	NC	No Connection		
7	NC	No Connection		
8	NC	No Connection		
9	SDP	No Connection		
10	NC	No Connection		
11	GND	Common		
12	TXD	Transmit Output	Transmit serial data	
13	NC	No Connection		
14	NC	No Connection		
15	RDN			
16	NC	No Connection		
17	NC	No Connection		
18	NC	No Connection		
19	SDN			
20	NC	No Connection		

The part number and manufacture information for connector J1and J2 is as follow:
Manufacture: 3M
Part number: N10220-52B2VC

ACC-57E TERMINAL BLOCKS

Connector TB1 Top - Encoder 1

Pin#	Symbol	Function	Description	Notes
1	CHA1+ or PHA1	Input/Output	Enc 1 Positive A Channel	
2	CHA1- or *PHA1	Input/Output	Enc 1 Negative A Channel	
3	CHB1+ or PHB1	Input/Output	Enc 1 Positive B Channel	
4	CHB1- or *PHB1	Input/Output	Enc 1 Negative B Channel	
5	CHC1+ or PHC1	Input/Output	Enc 1 Positive C Channel	Index channel
6	CHC1- or *PHC1	Input/Output	Enc 1 Negative C Channel	Index channel
7	ENCPWR	Output	Digital Supply	Power for encoder
8	GND	Common	Digital Reference	
9	SEN1	Power	+5V	
10	BAT+	Input	+3V	
11	BAT-	Input	Encoder Common	
12	FGND			

Connector TB2 Top - Encoder 2

Pin#	Symbol	Function	Description	Notes
1	CHA2+ or PHA2	Input/Output	Enc 2 Positive A Channel	
2	CHA2- or *PHA2	Input/Output	Enc 2 Negative A Channel	
3	CHB2+ or PHB2	Input/Output	Enc 2 Positive B Channel	
4	CHB2- or *PHB2	Input/Output	Enc 2 Negative B Channel	
5	CHC2+ or PHC	Input/Output	Enc 2 Positive C Channel	Index channel
6	CHC2- or *PHC	Input/Output	Enc 2 Negative C Channel	Index channel
7	ENCPWR	Output	Digital Supply	Power for encoder
8	GND	Common	Digital Reference	
9	SEN2	Power	+5V	
10	BAT+	Input	+3V	
11	BAT-	Input	Encoder Common	
12	FGND			

ACC-57E DB15 CONNECTOR OPTION

Connector J1 Top - Encoder 1

Pin#	Symbol	Function	Description	Notes
1	FGND			
2	BAT+	Input	+3V	
3	GND	Common	Digital Reference	
4	CHC1- or *PHC1	Input/Output	Enc 1 Neg. C Chan.	Index channel
5	CHB1- or *PHB1	Input/Output	Enc 1 Neg. B Chan.	
6	CHA1- or *PHA1	Input/Output	Enc 1 Neg. A Chan.	
7	N/C			Not connected
8	N/C			Not connected
9	BAT-	Input	Encoder Common	
10	SEN1	Power	+5V	
11	ENCPWR	Output	Digital Supply	Power for encoder
12	CHC1+ or PHC1	Input/Output	Enc 1 Pos. C Chan.	Index channel
13	CHB1+ or PHB1	Input/Output	Enc 1 Pos. B Chan.	
14	CHA1+ or PHA1	Input/Output	Enc 1 Pos. A Chan.	
15	N/C			Not connected

Connector J2 Top - Encoder 2

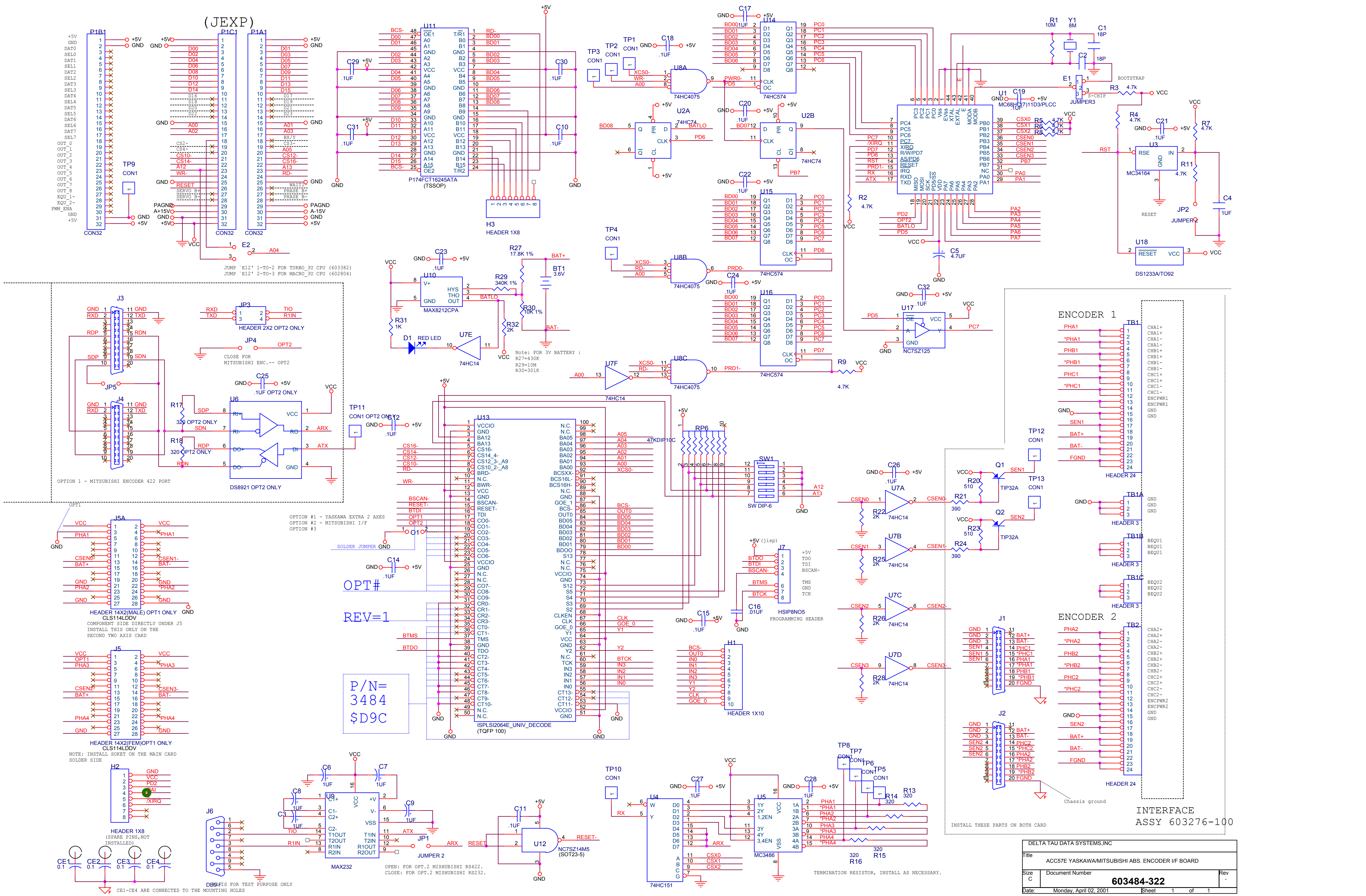
Pin#	Symbol	Function	Description	Notes
1	FGND			
2	BAT+	Input	+3V	
3	GND	Common	Digital Reference	
4	CHC2- or *PHC2	Input/Output	Enc 2 Neg. C Chan.	Index channel
5	CHB1- or *PHB1	Input/Output	Enc 2 Neg. B Chan.	
6	CHA1- or *PHA1	Input/Output	Enc 2 Neg. A Chan.	
7	N/C			Not connected
8	N/C			Not connected
9	BAT-	Input	Encoder Common	
10	SEN2	Power	+5V	
11	ENCPWR	Output	Digital Supply	Power for encoder
12	CHC2+ or PHC2	Input/Output	Enc 2 Pos. C Chan.	Index channel
13	CHB2+ or PHB2	Input/Output	Enc 2 Pos. B Chan.	
14	CHA2+ or PHA2	Input/Output	Enc 2 Pos. A Chan.	
15	N/C			Not connected

SERVOPACK 1CN TERMINAL DESCRIPTION

(For Σ series motor and absolute encoder)

Terminal	Sigma I	Description
1	SG	0V
2	SG	0V
3	PL1	Power supply for open collector reference
4	SEN	SEN signal input
5	V-REF	Speed reference input
6	SG	0V
7	PULS	Reference pulse input
8	*PULS	Reference pulse input
9	T-REF	Torque reference input
10	SG	0V
11	SIGN	Reference sign input
12	*SIG	Reference sign input
13	PL2	Power Supply for open collector reference
14	*CLR	Error counter clear input
15	CLR	Error counter clear input
16	TQR-M	Torque monitor
17	VTG-M	Speed monitor
18	PL3	Power supply for open collector reference
19	PCO	PG dividing output phase C
20	*PCO	PG dividing output phase C
21	BAT	Battery (+)
22	BAT0	Battery (-)
23	+12V	Power supply for speed/torque reference
24	-12V	Power supply for speed/torque reference
25	V-CMP(COIN+)	Speed coincidence signal output
26	V-CMP(COIN-)	Speed coincidence signal output
27	TGON+	TGON output signal
28	TGON-	TGON output signal
29	S-RDY+	Servo ready output
30	S-RDY-	Servo ready output
31	ALM+	Servo alarm output
32	ALM-	Servo alarm output
33	PAO	PG dividing output phase A
34	*PAO	PG dividing output phase A
35	PBO	PG dividing output phase B
36	*PBO	PG dividing output phase B
37	ALO1	Alarm code output (open collector output)
38	ALO2	Alarm code output (open collector output)
39	ALO3	Alarm code output (open collector output)
40	S-ON	Servo ON input
41	P-CON	P control input
42	P-OT	Forward over-travel input
43	N-OT	Reverse over-trivial input
44	ALM-RST	Alarm reset input
45	P-CL	Forward external torque limit ON input
46	N-CL	Reverse external torque limit ON input
47	+24V IN	External power supply input
48	PSO	Phase S signal output
49	*PSO	Phase S Signal output
50	FG	Frame ground

SCHEMATICS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603484-322
Date: Monday, April 02, 2001
Sheet 1 of 1
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ENCODER 2
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