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USER MANUAL

Accessory 85M

MACRO INTERFACE FOR YASKAWA SIGMA-V

3Ax-603928-xUxx

December 14, 2012



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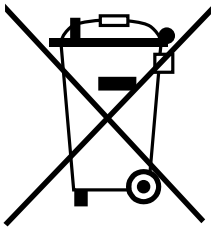
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INTRODUCTION

The MACRO SIGMA-V Application Module (ACC-85M) is an accessory card that connects to the Yaskawa Sigma-V (SGDV) amplifier. The purpose of this accessory card is to provide the MACRO fieldbus interface between Yaskawa Corp. amplifiers and Delta Tau Data Systems MACRO-based motion controllers.

This interface accessory card provides 2 outputs, one that is Open-collector style and another dedicated to higher speed triggered output that is Open-collector style and limited to 5V operation. This interface card also has 3 inputs that operate from 8-24Vdc. A 15-pin high density DSUB connector is used for the user's interface.

This accessory card requires the user to supply an external 12-24Vdc power supply for the I/O interfaces.

It should be noted that there are two types of SGDV amplifier. When specifying the Servopack be sure to request the "COMMAND OPTION ATTACHABLE TYPE". This Servopack has an external port connector that is used for peripheral devices. Contact Yaskawa for further information on exchanging amplifiers.

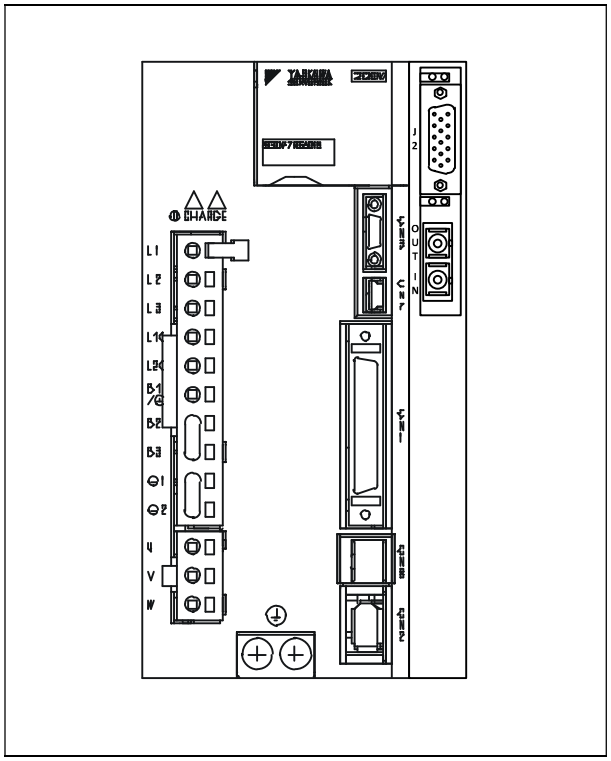


Figure 1: ACC-85M with OPT-A

Fiber Optic MACRO

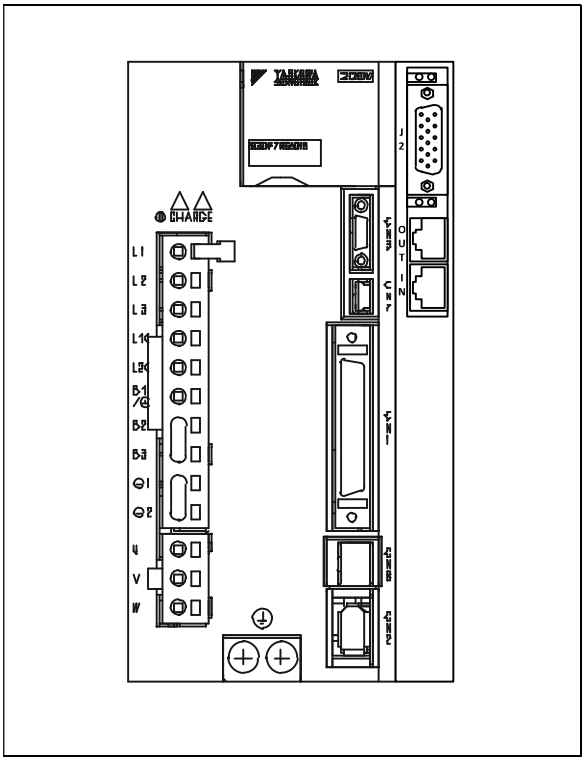


Figure 2: ACC-85M with OPT-C

Copper MACRO

Getting Started

Setup of Yaskawa Drive

Perform the installation and setup of the SGDV SIGMA-V drive "Command Option Attachable Type" per the recommendations of Yaskawa Corp.

This should include the electrical installation of the motor and the drive per the instruction manual supplied with the Yaskawa SIGMA-V drive.

You may use the SIGMAWIN setup program (provided by Yaskawa Corp.) to set up the drive's parameters, or enter parameters using the operator interface on the front of the SIGMA-V drive.

Since the SERVOPACK with Option Module is expecting an option module, if powered up without the ACC-85M connected to the drive, an error code will be generated (A.E70: Error of Command-Option Module not Detected) which should be cleared using the SIGMAWIN software. Once ACC-85M is connected and mounted in place, it can be detected by SERVOPACK and viewed in SIGMAWIN software.

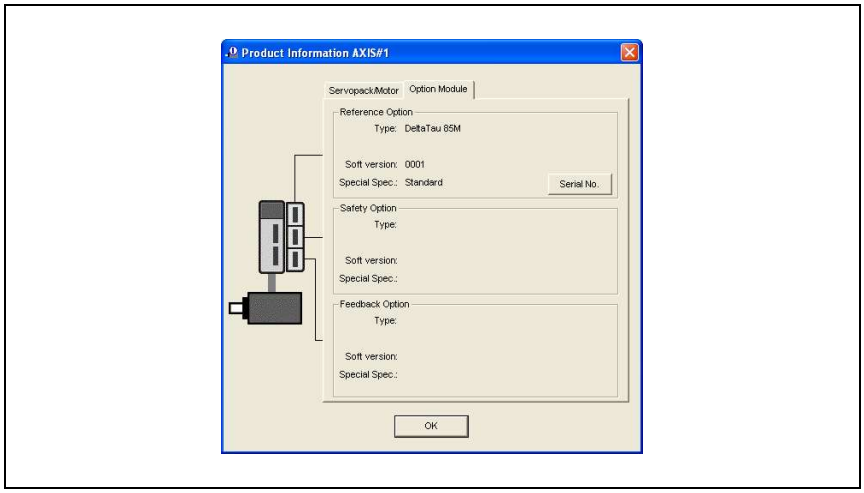


Figure 3: Product Information Window in SIGMAWIN software

Refer to the Appendix B in the SIGMA-V User's Manual for the list of parameters.

Useful Parameters Inside SGDV SIGMA-V Drive

There are a few parameter settings in the drive that, if known, will make the setup of the ACC-85M and motor interface easier. They are listed in the following table:

Table 1: Useful Parameters in SIGMA V SERVOPACK

PARAMETER	NOTES
Pn002.2	Set this value for the incremental use of an absolute encoder. Useful to consider when an encoder error A.810 occurs and the MTURN CLR (Fn008) does not work. If an absolute encoder is used that has no battery, you may encounter this issue. Set Pn002 = x1xx when this issue occurs.
Pn20E Pn210	These are encoder feedback gearing. A 20-bit encoder should return 1,048,576 counts per revolution when these values are set to 1. The factory default for these values is set to divide by resulting in lower resolution accessible through MACRO. It is recommended that these are set to 1 for better servo performance.
Pn50A Pn50B	These values are used to establish position overtravel limits. To bypass the limits set Pn50A = 8xxx (P-OT) and Pn50B = xxx8 (N-OT).

There are also parameters available to bypass wired functions such as SERVO ENABLE , POSITIVE OVERTRAVEL, and NEGATIVE OVERTRAVEL. Refer to Pn50A and Pn50B for setting these overrides.

WARNING

If the values of overrides are set to bypass the physical interface at the CN1 connector on the drive, dangerous over-travel or undesired motion may occur.

Caution must be used when operating the drive with any overrides enabled

To implement the incremental use of an absolute encoder, configure PN002.2 = 1. This is sometimes necessary if there is an absolute encoder used where there is no backup battery.

Gearing may be implemented by setting the parameters Pn20E and Pn210. Setting both of these to 1 will make a 20-bit encoder provide 1,048,576 counts per revolution which provides better performance both in velocity and torque mode control.

ACC-85M Hardware Setup

ACC-85M is designed to provide MACRO communication to Yaskawa Sigma V SERVOPACK drives. Each ACC-85M can be configured to use either a single servo node on the MACRO ring or one servo node and its corresponding IO node. This selection is done through rotary switches SW1 and SW2.

SW1 Slave Node Selector

Rotary switch SW1 determines which nodes are enabled on the ACC-85M station. If SW1 is set to E (14), Ring Order Method can be used to setup the node and master number of the station. If SW1 is set to F (15), default MI variables will be loaded upon power up.

Table 2: MI996 Settings for Various Node Selections

SW1	MI996 Value	Nodes Enabled
0	$0F1FE20	0
1	$0F1FE31	1
2	$0F3FE20	0,2
3	$0F3FE31	1,3
4	$0F1FE64	4
5	$0F1FE75	5
6	$0F3FE64	4,6
7	$0F3FE75	5,7
8	$0F1FEA8	8
9	$0F1FEB9	9
10	$0F3FEA8	8,10
11	$0F3FEB9	9,11
12	$0F1FE2C	12
13	$0F1FE3D	13
14	$0F0FE10	None (S/W Macro Ring Order Setup)
15	$0F1FE1B	11 (Set MI variables to factory default)

SW2 Master IC Selector

Rotary switch SW2 determines which Master number the station gets bind to. Setting SW1 to E(14) will set the station for Ring Order Method and setting of SW2 will not be used.

ACC-85M Software Setup

Software setup for ACC-85M can vary depending on users choice of using SW1 and SW2 settings for defining the binding MACRO master and active nodes or setting it through Ring Order Method. If SW1 is set to E (14), then Ring Order Setup will be used and MACRO ASCII communication should be used to setup the parameters and communication in ACC-85M. If SW1 and SW2 are set such that they define the binding MACRO master number and servo node, manual setup is preferred. Usually replacing a unit is easier if the setup is done using the rotary switches.

In either method, note that The Phase clock in the ACC-85M is defaulted to 10kHz (MI992=5000) and the Servo clock is defaulted to 2 kHz (MI998=4). Depending on required MACRO communication rate, defined by Phase clock frequency on Ultralite/UMAC, different Servo Clock Divider (MI998) values should be used to provide synchronized data communication between ACC-85M and SERVOPACK.

NOTE

Higher Servo frequencies allow for better compliance when tuning motors. Although the default is 2 kHz, we recommend trying to operate at 4 kHz or 8 kHz for best results in servo performance.

The following table provides some samples of phase clocking settings:

Table 3: Clock Settings Depending on Desired Servo Rates

Desired ACC-85M Servo Frequency [1]	MACRO Comm. Freq.(PhaseFreq.)	Ultralite / UMAC Settings	ACC-85M Settings
2 kHz	10 kHz	I6800=5895 I6801=0 I6802=4 I10=4193067	MI992=5000 (default) MI998=4 (default)
4 kHz	8 kHz	I6800=7371 I6801=0 I6802=1 I10=2097067	MI992=6250 MI998=1
8 kHz	8 kHz	I6800=7371 I6801=0 I6802=0 I10=1048533	MI992=6250 MI998=0
8 kHz	16 kHz	I6800=3684 I6801=0 I6802=1 I10=1048320	MI992=3125 MI998=1

[1] SERVO frequency must be set to operate at 1KHz, 2KHz, 4KHz, 8KHz, or 16KHz for proper synchronization of cyclical data between the amplifier and the UMAC motion controller. Other combinations are possible. Refer to the Ixxxx and Mixxx parameters in their respective manuals for alternate values.

MACRO Ring Order Method

In PMAC Executive PRO2 version 4.2.12.0 or newer, MACRO Ring ASCII setup (accessible through Configure Menu) can be utilized to setup the ACC-85M over the MACRO ring.

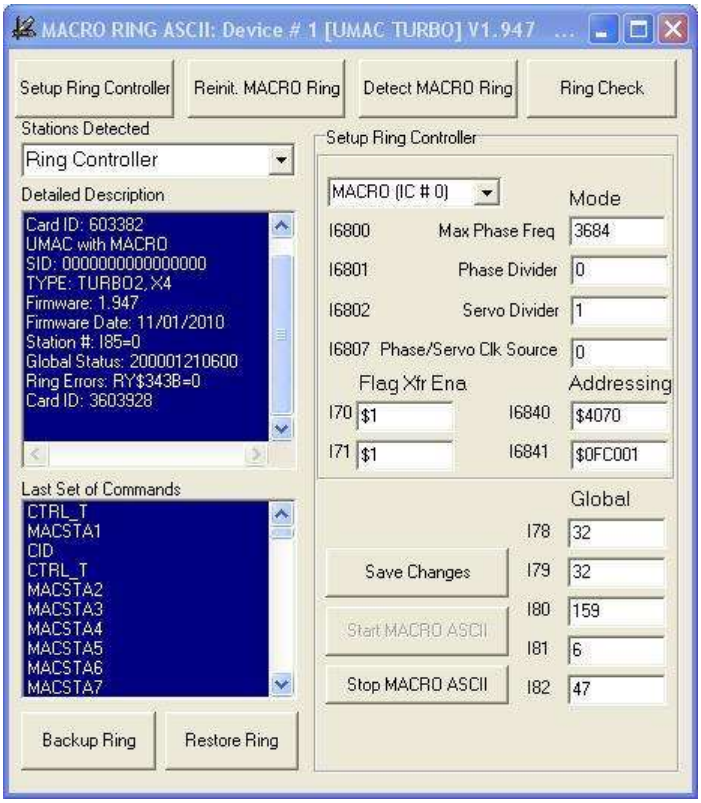


Figure 4: MACRO RING ASCII Window; Controller Setup

In this setup assistant page, follow these steps (for detailed explanation on all the parameters, refer to Turbo PMAC Software Reference Manual)

1. Set proper values to I6800, I6801, I6802 (based upon the table in previous page) to get proper clock settings on the Ultralite/UMAC.
2. Set I6840 to $4070 to set the MACRO IC 0 as synchronizing master.
3. Set I6841 to $FC001 or appropriate value to enable the required nodes.
4. Set I70 and I71 to corresponding values to resemble servo nodes enabled on I6841.
5. Set I78 to 32 for Master/Slave communication timeout.
6. Click Save Changes. (Respond **No** to the question about saving the parameters on stations)
7. Once saving is finished, click Setup Ring Controller button (Select No in response to a pop-up question of issuing a $$$*** to the controller). This will set proper values for I80, I81, and I82.
8. Click Save Changes. (Respond **Yes** to the question about saving the parameters on stations)
9. Click Reinit. MACRO Ring button.
10. Click Detect MACRO Ring button.

11. After completion of step 9, you should be able to see a list of all your MACRO stations under the drop-down list called “Stations Detected” and they ate automatically numbered from 1, starting from the station downstream of the Ultralite/UMAC.
12. Select the station number for ACC-85M. The data shown under “Detailed Description” should match your hardware.

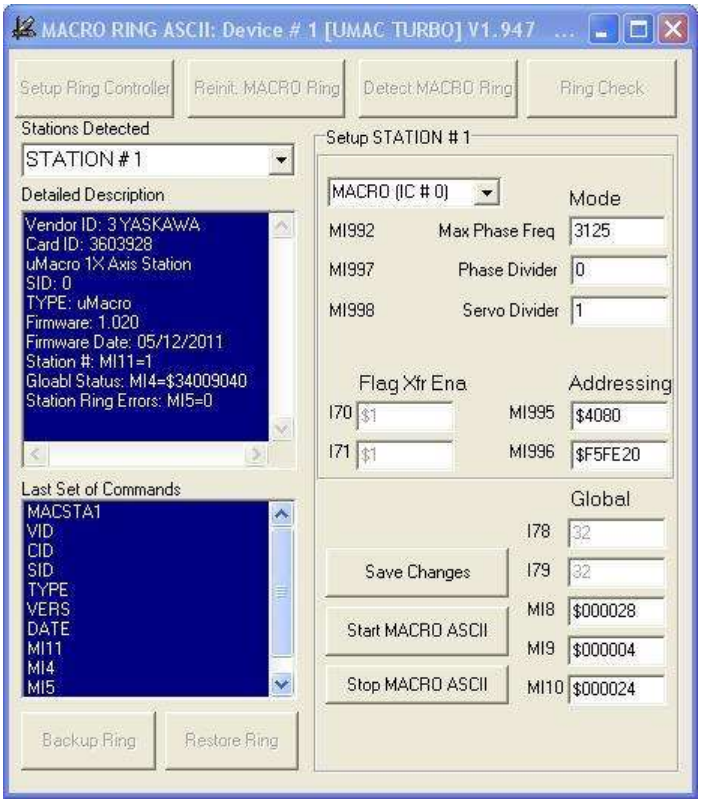


Figure 5: MACRO RING ASCII Window; Station Setup

13. Setup MI992 and MI998 based upon table 3.
14. Setup MI995 to default value of $4080.
15. Setup MI996 based upon table 2. (First Nibble Represents the Master Number)
16. Set proper values for MI8, MI9 and MI10. (refer to uMACRO manual for detailed information)
17. Click Save Changes button and request that changes only be saved on selected station.
18. Repeat steps 12 to 17 for all stations.
19. Power Cycle the station so ACC-85M and SERVOPACK synchronize..

If you get an A.E00 error on the drive display, check the MI20 and MI21 settings on ACC-85M. MI20 and MI21 should be set less than or equal to MI998 setting. Once updated, save and reset the station.

Once all the stations are setup, user should continue with Turbo PMAC Ultralite/UMAC Motor Setup Section.

Rotary Switch Address Setting

In this method, the node number must be established in the ACC-85M by setting the addressing switches. Refer to Hardware Setup section for configuration detailed on switch settings and their corresponding nodes.

Connect the MACRO ring between the Ultralite/UMAC and all stations and follow these steps to setup the MACRO ring:

1. Select the Phase and Servo clock based upon table 3 and setup I6800 (I6850/I6900/I6950), I6801 (I6851/I6901/I6951), I6802 (I6852/I6902/I6952) and I10 accordingly. (Note: if there are more than 1 master IC, corresponding clock setting I-variables has to be modified to reflect the same clock settings on all master ICs)
2. Setup I6840 to $4030 to make the first IC the synchronizing ring controller. I6890/I6940/I6990 if available should be set to $10. ($90 if the ICs are not on sharing phase and servo clocks through hardware such as bus or backplane)
3. Setup I6841/I6891/I6941/I6991 to enable the nodes desired. The nodes enabled should match the node settings on ACC-85M(s) based upon their rotary switch settings.
4. Set I70/I72/I74/I76 and I71/I73/I75/I79 according to I6841/I6891/I6941/I6991 settings. These will enable Node Auxiliary Registers and sets the Node Protocol Type Control.
5. Set I78 and I79 to 32.
6. Set I80, I81 and I82 depending on the clock settings and related calculations explained in detail in Turbo Software Reference manual. (This step is optional if user wants to enable automatic ring error check)
7. Save the settings on Ultralite/UMAC by issuing a SAVE command and reset the controller by issuing a $$$ command.

Up to this point the controller is setup and ready to communicate on the MACRO ring. The rest of the setup is for each station and has to be repeated for each station. During setup, it would be a good idea to have the Global Status window, accessible through View menu, open to keep an eye on MACRO errors. MACRO errors can be cleared using CLRF (clears errors on MACRO controller) and MSCLRFn (clears MACRO errors on station with node number n).

8. Setup MI992 based upon table 3. (The MI-variables can be set by using MACROSLAVE commands or MS commands. For example MS0,MI992=3125 will set MI992 to 3125 and to query a MI-variable send command as MS0,MI992 and the response will be the value which MI992 is holding.)
9. Issue a save on the station using MACROSLAVESAVEn command. (MSSAVEn will save the parameters on station with node n enabled.)
10. Reset the station using the MACROSLAVE$$$n command. (MS$$$n will reset the station with node n enabled)
11. Setup MI998 based upon table 3.
12. Issue a save on the station using MSSAVEn command.
13. Reset the station using the MS$$$n command.
14. Power Cycle the station so ACC-85M and SERVOPACK synchronize.
15. Setup MI20 and MI21 according to uMACRO manual. (MI20 and MI21 should be set less than or equal to MI998 setting. Once updated, save and reset the station.)

Steps 8 to 15 have to be repeated for all stations. Once all the stations are setup, user should continue with Turbo PMAC Ultralite/UMAC Motor Setup Section.

Turbo PMAC Ultralite/UMAC PMAC Motor Setup

Once the ACC-85M is setup, by default it will transmit the encoder position over MACRO ring through the assigned node and receives the commands on the same node. The following setting are general guidelines for setting up a motor in PMAC and other detailed settings can be done based upon Turbo PMAC Software Reference manual and uMACRO Software Reference Manual.

Encoder Conversion Table Setup (I8000..8191 / Ixx03 / Ixx04)

The encoder position is reported back on MACRO ring every phase clock, but the data is only updated between SERVOPACK and ACC-85M every servo cycle defined by MI992 and MI998 settings. This data has to be read by Encoder Conversion Table (ECT) in PMAC before it can be used as position/velocity feedback.

NOTE

In Yaskawa Sigma V SERVOPACK, gearing may be implemented by setting the parameters Pn20E and Pn210. Default setting for these parameters, will result in ¼ of actual encoder position reporting on MACRO ring. Setting both of these to 1 will provide full resolution to Turbo PMAC Ultralite/UMAC, This provides better performance both in velocity and torque mode control.

For reading the primary feedback from ACC-85M, Yaskawa motor feedback, conversion type $2 has to be used. This conversion method is a two line entry in ECT and can be done either though I-variable setting or Encoder Conversion Table Setup tool accessible through Configure menu of PEWIN32PRO2.

First line of the entry specifies which node the position data is located.

Table 4: Encoder Conversion Table 1st line Setting for Primary Feedback

Register	First Line Value	Register	First Line Value
MACRO IC 0 Node 0 Reg. 0	$2F8420	MACRO IC 2 Node 0 Reg. 0	$2FA420
MACRO IC 0 Node 1 Reg. 0	$2F8424	MACRO IC 2 Node 1 Reg. 0	$2FA424
MACRO IC 0 Node 4 Reg. 0	$2F8428	MACRO IC 2 Node 4 Reg. 0	$2FA428
MACRO IC 0 Node 5 Reg. 0	$2F842C	MACRO IC 2 Node 5 Reg. 0	$2FA42C
MACRO IC 0 Node 8 Reg. 0	$2F8430	MACRO IC 2 Node 8 Reg. 0	$2FA430
MACRO IC 0 Node 9 Reg. 0	$2F8434	MACRO IC 2 Node 9 Reg. 0	$2FA434
MACRO IC 0 Node 12 Reg. 0	$2F8438	MACRO IC 2 Node 12 Reg. 0	$2FA438
MACRO IC 0 Node 13 Reg. 0	$2F843C	MACRO IC 2 Node 13 Reg. 0	$2FA43C
MACRO IC 1 Node 0 Reg. 0	$2F9420	MACRO IC 3 Node 0 Reg. 0	$2FB420
MACRO IC 1 Node 1 Reg. 0	$2F9424	MACRO IC 3 Node 1 Reg. 0	$2FB424
MACRO IC 1 Node 4 Reg. 0	$2F9428	MACRO IC 3 Node 4 Reg. 0	$2FB428
MACRO IC 1 Node 5 Reg. 0	$2F942C	MACRO IC 3 Node 5 Reg. 0	$2FB42C
MACRO IC 1 Node 8 Reg. 0	$2F9430	MACRO IC 3 Node 8 Reg. 0	$2FB430
MACRO IC 1 Node 9 Reg. 0	$2F9434	MACRO IC 3 Node 9 Reg. 0	$2FB434
MACRO IC 1 Node 12 Reg. 0	$2F9438	MACRO IC 3 Node 12 Reg. 0	$2FB438
MACRO IC 1 Node 13 Reg. 0	$2F943C	MACRO IC 3 Node 13 Reg. 0	$2FB43C

Note that the bit-19 mode switch has been set to 1 so that the data out of the MACRO node is not shifted. This changes the second hex digit from 7 to F. Type 1 MACRO feedback comes with fractional count information in the low five bits, so it does not need to be shifted. (Default setting of MI20 bit 0 to a value of 0 on ACC-85M will provide 5 bits of left shift to send all feedback resolution as whole counts to MACRO controller. With the default setting, there is no need for additional shift on the Ultralite side, so bit 19 of the encoder conversion table is set to 1, disabling the shifting. If the MI20 bit 0 is set to 1, then

the position is not shifted on the ACC-85M before it gets transmitted over MACRO and the data needs to be shifted on the Ultralite side, by setting bit 19 of the first line of encoder conversion table entry to 0.)

The second line of an entry for MACRO feedback should be $018000 to specify the use of 24 bits ($018) starting at bit 0 ($000).

Once the encoder conversion table entry is ready, Ix03 and Ix04 of the desired PMAC motor has to point to the address of the second line which holds the processed data.

For example, for an ACC-85M which is on node 0 and motor 1, I8000=$2F8420, I8001=$018000 and I103=$3502 and I104=$3502.

For complete list of addresses for each encoder conversion table line, please refer to Turbo Software Reference Manual.

Command Output Address (Ixx02)

Command output is addressed by Ixx02 setting in PMAC and Table 5 shows different settings for Ixx02 based upon the node selection on ACC-85M

Table 5: Command Output Address for MACRO Nodes

Register	Ixx02 Setting	Register	Ixx02 Setting
MACRO IC 0 Node 0 Reg. 0	$078420	MACRO IC 2 Node 0 Reg. 0	$07A420
MACRO IC 0 Node 1 Reg. 0	$078424	MACRO IC 2 Node 1 Reg. 0	$07A424
MACRO IC 0 Node 4 Reg. 0	$078428	MACRO IC 2 Node 4 Reg. 0	$07A428
MACRO IC 0 Node 5 Reg. 0	$07842C	MACRO IC 2 Node 5 Reg. 0	$07A42C
MACRO IC 0 Node 8 Reg. 0	$078430	MACRO IC 2 Node 8 Reg. 0	$07A430
MACRO IC 0 Node 9 Reg. 0	$078434	MACRO IC 2 Node 9 Reg. 0	$07A434
MACRO IC 0 Node 12 Reg. 0	$078438	MACRO IC 2 Node 12 Reg. 0	$07A438
MACRO IC 0 Node 13 Reg. 0	$07843C	MACRO IC 2 Node 13 Reg. 0	$07A43C
MACRO IC 1 Node 0 Reg. 0	$079420	MACRO IC 3 Node 0 Reg. 0	$07B420
MACRO IC 1 Node 1 Reg. 0	$079424	MACRO IC 3 Node 1 Reg. 0	$07B424
MACRO IC 1 Node 4 Reg. 0	$079428	MACRO IC 3 Node 4 Reg. 0	$07B428
MACRO IC 1 Node 5 Reg. 0	$07942C	MACRO IC 3 Node 5 Reg. 0	$07B42C
MACRO IC 1 Node 8 Reg. 0	$079430	MACRO IC 3 Node 8 Reg. 0	$07B430
MACRO IC 1 Node 9 Reg. 0	$079434	MACRO IC 3 Node 9 Reg. 0	$07B434
MACRO IC 1 Node 12 Reg. 0	$079438	MACRO IC 3 Node 12 Reg. 0	$07B438
MACRO IC 1 Node 13 Reg. 0	$07943C	MACRO IC 3 Node 13 Reg. 0	$07B43C

Motor Flag Address (Ixx25)

Ixx25 tells Turbo PMAC what registers it will access for its position-capture flags, and possibly its overtravel-limit input flags and amplifier enable/fault flags, for Motor xx. Ixx25 Addresses for MACRO Flag Holding Registers are listed in Table 6.

Table 6: Addresses for MACRO Flag Holding Registers

IC Node #	MACRO IC 1	MACRO IC 2	MACRO IC 3	MACRO IC 4	Notes
0	$003440	$003450	$003460	$003470	MACRO Flag Register Sets 0, 16, 32, 48
1	$003441	$003451	$003461	$003471	MACRO Flag Register Sets 1, 17, 33, 49
4	$003444	$003454	$003464	$003474	MACRO Flag Register Sets 4, 20, 36, 52
5	$003445	$003455	$003465	$003475	MACRO Flag Register Sets 5, 21, 37, 53
8	$003448	$003458	$003468	$003478	MACRO Flag Register Sets 8, 24, 40, 56
9	$003449	$003459	$003469	$003479	MACRO Flag Register Sets 9, 25, 41, 57
12	$00344C	$00345C	$00346C	$00347C	MACRO Flag Register Sets 12, 28, 44, 60
13	$00344D	$00345D	$00346D	$00347D	MACRO Flag Register Sets 13, 29, 45, 61

Motor Flag Mode Control (Ixx24)

Motor flag mode control specifies how the flag information in the registers specified by Ixx25, Ixx42, and Ixx43 is used. Ixx24 is a set of 24 individual control bits and the following figure summarizes the functionality for each of these bits.

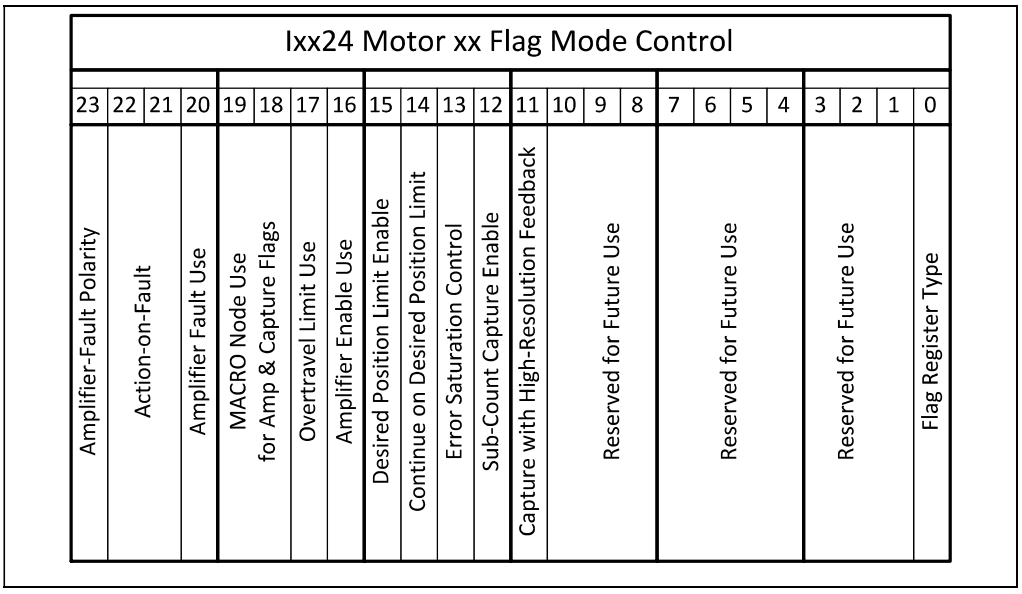


Figure 6: Ixx24 Motor xx Flag Mode Control

Setting Ixx24 for SERVOPACK with ACC-85M requires the following bits to be set appropriately:

- Bit 0: flag registers are in PMAC2-style Servo IC format. This bit has to be set high.
- Bit 17: Overtravel limit Use: If the overtravel limits are wired to SERVOPACK drive and they are enabled through SERVOPACK parameters Pn50A.3 and Pn50B.0, both SERVOPACK and Turbo PMAC Ultralite/UMAC will take action upon overtravel condition which causes a conflict in control. If use of overtravel limits are required, a set of overtravel inputs are provided on J2 connector of ACC-85M and by setting bits 2 and 3 of MI23, ACC-85M will transfer these inputs as positive and negative overtravel limits over MACRO ring. If overtravel limits are to be disabled, set this bit high.
- Bits 18 and 19: Since all amplifier enable, amplifier fault and capture flags are transferred over MACRO ring, bit 18 is 1 and bit 19 is 0.
- Bit 23: Since Yaskawa Sigma V SERVOPACK has a high true fault (it reports a 1 when indicating a fault condition), this bit should be set to 1.

For example if overtravel limits are not being used, Ixx24=$860001 and if overtravel limits are wired to J2 on ACC-85M, MI23=$C and Ixx24=$840001.

Power-On Servo Position Setup (Ixx10/Ixx95)

If Yaskawa Sigma V motor connected to SERVOPACK has absolute encoder, the absolute position can be read through ACC-85M by setting proper values to motor xx power-on servo position address (Ixx10) and motor xx power-on servo position format (Ixx95). Default setting for bit 2 of MI20 on ACC-85M, will transfer the non-cyclic absolute position data returned as received, which means it will send the LSB of the absolute position as bit 0 of the MI920 which matches the cyclic position feedback resolution.

NOTE

Setting up automatic reading of absolute servo position over MACRO ring (Bit 3 of Ixx80 = 0) is NOT recommended since power up sequence and timing between SERVOPACK and Turbo PMAC Ultralite/UMAC becomes important. Instead, it is suggested that Ixx80 is set to 4, disabling automatic read of absolute position upon power-up/reset of controller and a #n$* command in initialization PLC is used after possible MACRO errors are cleared first using CLRF and MSCLRFn commands.

Failure to read the absolute position upon power-up, can cause PMAC to become unresponsive to ASCII communications with the host pc.

The following table shows the required values of Ixx10 for all of the MACRO nodes that can be used.

Table 7: MACRO Absolute Position Read Ixx10 Settings

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

Ixx95 specifies how the absolute power-on servo-position data, if any, for Motor xx is interpreted. Setting Ixx95 to a value of $740000 will result in an unsigned interpretation of absolute position reported from SERVOPACK and ACC-85M. In contrast a setting value of $F40000 will interpret the data as signed value.

Tuning and Running the Motor

Depending on command mode selection on the drive (MI30) velocity or torque (default) mode, as explained in special mi- parameters for ACC-85M, tuning should be performed just like any other PMAC motor. PMAC Tuning PRO2 software can be used for this purpose.

Secondary Encoder

ACC-85M provides a convenient solution for adding a secondary encoder to the system, which can be used a position feedback or a general handwheel input. This input supports the following input formats:

- Quadrature (A-Quad-B)
- Pulse and direction
- Pulse up/pulse down
- Hall format (UVW)

Secondary Encoder Setup on ACC-85M

ACC-85M supports multiple formats of feedback on J2 connector. MI910 determines the format and positive direction of the encoder feedback. Please refer to connector pin out section of the manual for detailed information on wiring instructions. Refer to uMACRO Software Reference for the settings of MI910. The other registers in the accessory are set to default values to allow a quadrature encoder to operate.

Once the encoder feedback in interpreted by ACC-85M, MI23 determines how this data should be transferred to Turbo PMAC Ultralite/UMAC over MACRO ring. This data can be sent over the MACRO ring in two formats, depending on bit 0 and bit 1 of MI23.

If bit 0 of MI23 is set to 1, the cyclic secondary position data is returned in registers 1 and 2 servo node as two 16 bit words. In this mode the data has 8 bits of 1/T sub-count resolution. There is no automatic full support for this format of data in Turbo PMAC Ultralite/UMAC encoder conversion table settings.

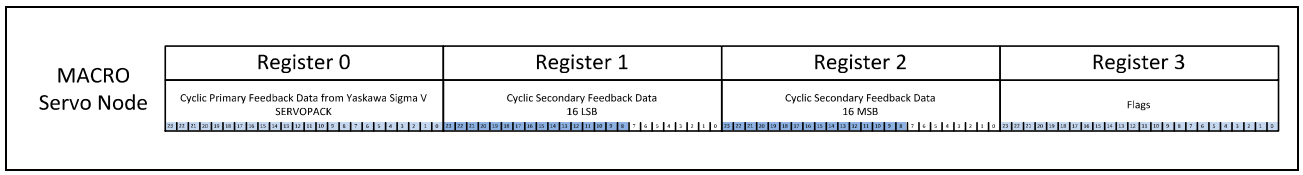


Figure 7: Cyclic Secondary Feedback Format with MI23=1

If bit 1 of MI23 is set to 1, the cyclic secondary position data is returned register 0 of the corresponding IO node. This IO node has to be enabled using switch SW1 or MI996 setting. In this mode the data has 5 bits of sub-count resolution.

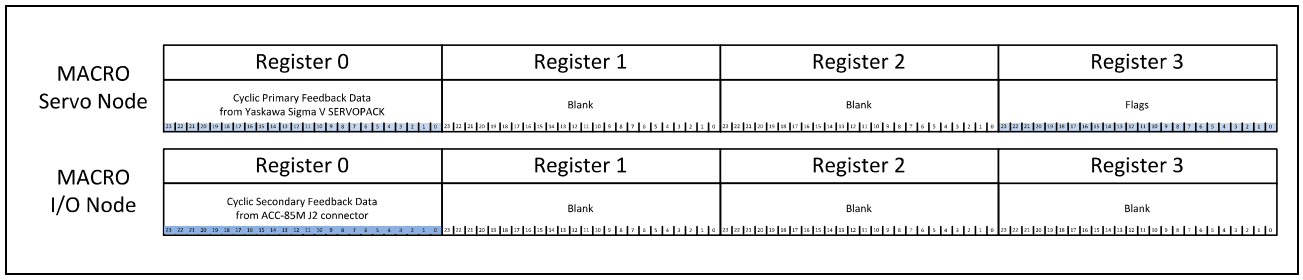


Figure 8: Cyclic Secondary Feedback Format with MI23=2

To input the register 0 of MACRO IO node to PMAC motor registers, the encoder conversion table conversion type $6, Parallel Y/X-word data with no filtering, should be used.

First line of the entry specifies which node the secondary position data is located.

Table 8: Encoder Conversion Table 1st line Setting for Secondary Feedback

Register	First Line Value	Register	First Line Value
MACRO IC 0 Node 2 Reg. 0	$6F8420	MACRO IC 2 Node 2 Reg. 0	$6FA420
MACRO IC 0 Node 3 Reg. 0	$6F8424	MACRO IC 2 Node 3 Reg. 0	$6FA424
MACRO IC 0 Node 6 Reg. 0	$6F8428	MACRO IC 2 Node 6 Reg. 0	$6FA428
MACRO IC 0 Node 7 Reg. 0	$6F842C	MACRO IC 2 Node 7 Reg. 0	$6FA42C
MACRO IC 0 Node 10 Reg. 0	$6F8430	MACRO IC 2 Node 10 Reg. 0	$6FA430
MACRO IC 0 Node 11 Reg. 0	$6F8434	MACRO IC 2 Node 11 Reg. 0	$6FA434
MACRO IC 1 Node 2 Reg. 0	$6F9420	MACRO IC 3 Node 2 Reg. 0	$6FB420
MACRO IC 1 Node 3 Reg. 0	$6F9424	MACRO IC 3 Node 3 Reg. 0	$6FB424
MACRO IC 1 Node 6 Reg. 0	$6F9428	MACRO IC 3 Node 6 Reg. 0	$6FB428
MACRO IC 1 Node 7 Reg. 0	$6F942C	MACRO IC 3 Node 7 Reg. 0	$6FB42C
MACRO IC 1 Node 10 Reg. 0	$6F9430	MACRO IC 3 Node 10 Reg. 0	$6FB430
MACRO IC 1 Node 11 Reg. 0	$6F9434	MACRO IC 3 Node 11 Reg. 0	$6FB434

Note that the bit-19 mode switch has been set to 1 so that the data out of the MACRO node is not shifted. This changes the second hex digit from 7 to F. Secondary feedback on register 0 of MACRO IO node matches type 1 MACRO feedback, which comes with fractional count information in the low five bits,

hence it does not need to be shifted. Default setting 0 for bit 2 of MI23, provides 5 bits of fractional count for cyclic secondary feedback.

The second line of an entry for secondary feedback on MACRO IO node must be set to $018018 to specify the use of 24 bits ($018) starting at bit 24 ($018) on the X/Y word.

Once the encoder conversion table entry is ready, Ix03 of the desired PMAC motor has to point to the address of the second line which holds the processed data if this feedback is a position feedback for the motor (load feedback).

For quadrature encoders, hardware checks for proper state transition between quadrature states and indicates an error in pattern by setting bit 30 of channel status word (MI938) to high.

Digital I/O

ACC-85M has multiple inputs and output pins available for user:

- 3 opto-coupled inputs
  - Positive over-travel flag input (Normally closed)
  - Negative over-travel flag input (Normally closed)
  - Home flag input
  - Note that these inputs can be used as general purpose inputs if required by user.
  - 8 – 24VDC support
  - Both sinking and sourcing inputs are possible (dependent of user wiring)
- 1 opto-coupled, open collector output
  - 8 – 24VDC support
  - 200 mA max current
  - Both sinking and sourcing output is possible (dependent of user wiring)
- 1 high speed TTL sinking output (not opto-coupled, EQU)
  - 300 mA max current

Flag inputs

3 opto-coupled inputs can be either used as general purpose input, in which case their status is available on bits 8, 9 and 10 of MI938, or they can be used as over-travel and home flags by setting bits 3 and 4 of MI23 to 1, which reports in input states as over-travel and capture bits in register 3 of MACRO servo node.

Table 9: ACC-85M Inputs and addressing

Input Pin	GPIO Use	Flags Use
J2-4	MI938, bit8	Home Flag (MI23 bit 4 set to 1)
J2-14	MI938, bit 9	Positive Over-travel Flag (MI23 bit 3 set to 1)
J2-9	MI938, bit 10	Negative Over-travel Flag (MI23 bit 3 set to 1)

Important Note on Using the Flags

Over travel limits on J2 can be utilized by setting bit 3 of MI23 to 1 and enabling the over-travel limits in Ixx24 in PMAC (set bit 17 of Ixx24 to 0). However, use of home flag requires extra attention.

If the cyclic primary feedback (Yaskawa motor feedback) is being used for both position and velocity feedback of the motor, but user wants to use a home or over-travel flag for establishing a position reference, then following setting has to be implemented:

Homing based upon the index pulse of Yaskawa motor (Hardware Capture):

```
MSn,MI23=$0          // n: Servo Node Number
                     // Bit 5=0: Get Home Capture Position from Primary Source
Ixx97=0              // xx: PMAC motor number
                     // Hardware position capture is possible
```

Homing based upon the Home Flag wired to J2 (Software Capture):

```
MSn,MI23=$20         // n: Servo Node Number
                     // Bit 5=1: Get Home Capture Position from Secondary Source
Ixx97=1              // xx: PMAC motor number
                     // Software position capture required since the captured position
                     // in MI921 is from secondary feedback source
MSn,MI912=2          // a setting of 2 or 10 defines trigger level of capture flag
                     // Low to high or high to low
MSn,MI913=0          // Select home flag as capture flag
```

Homing based upon the Home Flag wired to J2 (Software Capture):

```
MSn,MI23=$20         // n: Servo Node Number
                     // Bit 5=1: Get Home Capture Position from Secondary Source
Ixx97=1              // xx: PMAC motor number
                     // Software position capture required since the captured position
                     // in MI921 is from secondary feedback source
MSn,MI912=2          // a setting of 2 or 10 defines trigger level of capture flag
                     // Low to high or high to low
MSn,MI913=1          // Setting of 1 or 2 for Selecting Pos/Neg flag as capture flag
Ixx24=$860001        // Setting bit 17 of Ix24 disables the over-travel limit function
                     // on PMAC motor allowing homing based upon a limit flag
                     // only necessary if bit 3 of MI23 is set to 1
```

If cyclic secondary feedback (encoder connected to J2 on ACC-85M) is used for position feedback and primary feedback (Yaskawa SERVOPACK encoder) is used for velocity feedback, the following setup has to be implemented:

Homing based upon index pulse of your position encoder wired to J2 (Hardware Capture):

```
MSn,MI23=$2          // n: Servo Node Number
                     // Bit 1=1: Cyclic Secondary Position Data is returned in IO Node
                     // 24 bit registers 0
                     // Bit 5=1: Get Home Capture Position from Secondary Source
Ixx97=0              // xx: PMAC motor number
                     // Hardware position capture is possible
MSn,MI912=1          // Position capture based upon the index pulse of secondary encoder
```

Homing based upon home flag wired to J2 (Hardware Capture):

```
MSn,MI23=$22         // n: Servo Node Number
                     // Bit 1=1: Cyclic Secondary Position Data is returned in IO Node
                     // 24 bit registers 0
                     // Bit 5=1: Get Home Capture Position from Secondary Source
Ixx97=0              // xx: PMAC motor number
                     // Hardware position capture is possible
MSn,MI912=2          // a setting of 2 or 10 defines trigger level of capture flag
                     // Low high or high low (or any combination with index signal)
MSn,MI913=0          // Select home flag as capture flag
```

Homing based upon limit flags wired to J2 (Hardware Capture):

```
MSn,MI23=$22          // n: Servo Node Number
                      // Bit 5=1: Get Home Capture Position from Secondary Source
Ixx97=0               // xx: PMAC motor number
                      // Hardware position capture is possible
MSn,MI912=2           // a setting of 2 or 10 defines trigger level of capture flag
                      // Low high or high low (or any combination with index signal)
MSn,MI913=1           // Setting of 1 or 2 for Selecting Pos/Neg flag as capture flag
Ixx24=$860001         // Setting bit 17 of Ix24 disables the over-travel limit function
                      // on PMAC motor allowing homing based upon a limit flag
                      // only necessary if bit 3 of MI23 is set to 1
```

General Purpose Output

There is one opto-coupled, open collector output available on ACC-85M which is connected to GPIO00. This output can be used as sinking or sourcing as shown in following diagrams:

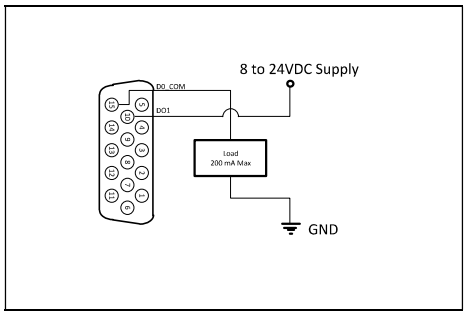


Figure 9: Sourcing Output

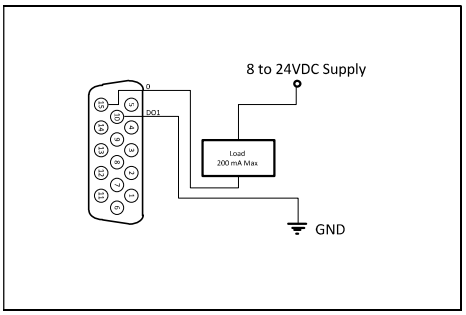


Figure 10: Sinking Output

To enable the GPIO00 as output, bit 0 of MI936 should be set to 1 and saved. The status of output can be controlled by writing to bit 0 of MI935.

High Speed TTL Output

On J2 connector of ACC-85M, there is also one output (not opto-coupled) that is connected to position compare circuitry output (EQU) that operates at high speed based upon secondary encoder. To use position compare feature on ACC-85M, parameters MI925, MI926 and MI927 has to be set.

Position compare circuitry, compares the position of secondary encoder with values in position compare registers A and B, MI925 and MI926, and turns the EQU output on/off upon detection of the edge. In addition, the position compare circuitry is capable of automatically incrementing the edges to produce a pulse train dependent on secondary position. This auto-increment period can be defined using MI928.

There are two methods for defining the auto-increment:

1. The pulse train starts around the actual phase captured position of secondary encoder.
2. The pulse train starts further away from actual position of secondary encoder. This is usually desired for applications where the pulse output has to start once the speed is constant.

To setup the pulses around the current position, user has to “bracket” the current position between the compare values A and B.

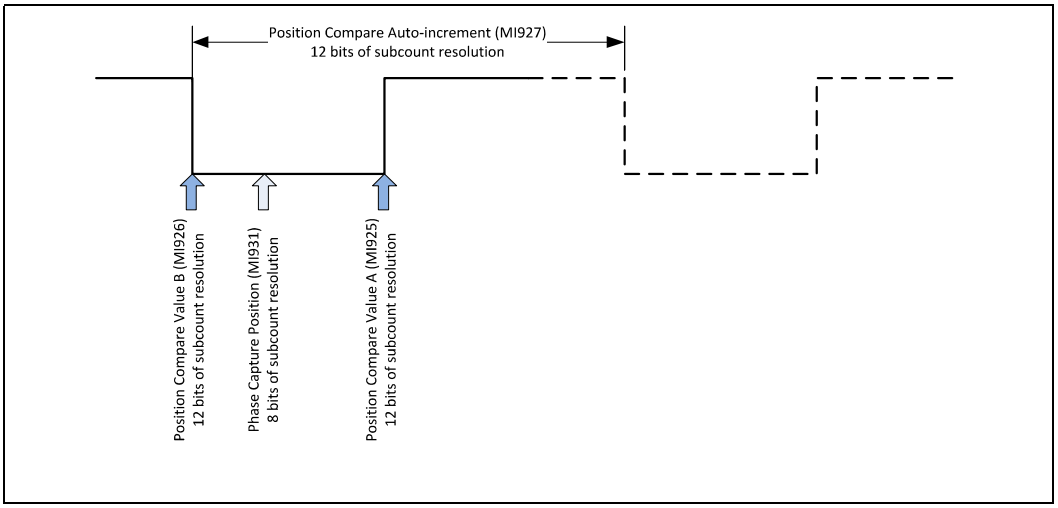


Figure 11: EQU Method 1, "Bracketing" the Actual Position

In this method, the value for MI925, MI926 and MI927 has to be written without any modification to MI928 or MI929. In this method once each edge is detected, the state of EQU output toggles and auto-increment value will be added or subtracted from the other compare value depending on the direction of travel.

In second method, the value for edges A (MI925) and B (MI926) and auto-increment (MI927) are setup on one side of present actual position and initial states of EQU is set by writing to MI929 and toggling MI928.

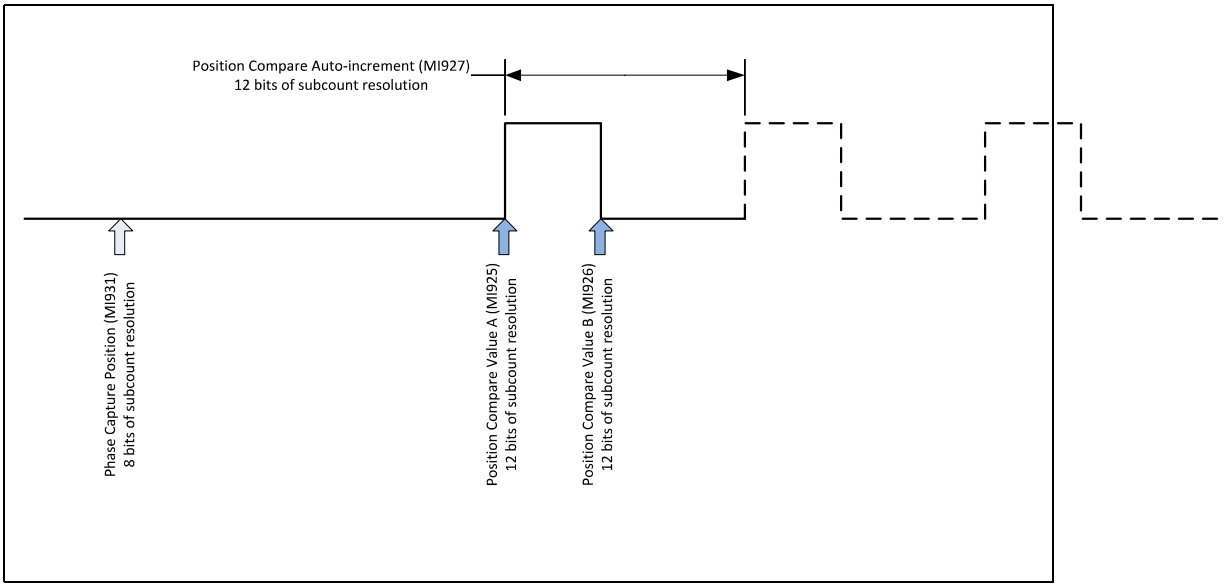


Figure 12: EQU Method 2, Pulse Generation with Distant Starting Position

In this method, toggling the MI928 flags the circuit not to auto-increment for first edge detection, allowing the actual position to be "bracketed" between the edges A and B, and from that point, acts as method 1, whenever the actual position reaches one of the edges, it adds/subtracts auto-increment value to/from other compare value.

NOTE

Position compare values A (MI925) and B (MI926) and position compare auto-increment (MI927) value have 12 bits of 1/T sub-count resolution in contrast to phase captured position register (MI931) which has 8 bits of 1/T sub-count resolution. Since usually the values of position compare A and B are setup based upon the present actual position, it is important to remember the scale factor of 16 between the data source (MI931) and target (MI925, MI926 and MI927)

NOTE

Position compare auto-increment (MI927) value has 12 bits of 1/T sub-count resolution, but in order for circuit to work consistently, the minimum possible value is equal to 2049, representing a 1/4096 count more than half a count.

DISPLAYS

All indicators appear at the front panel of this accessory card.

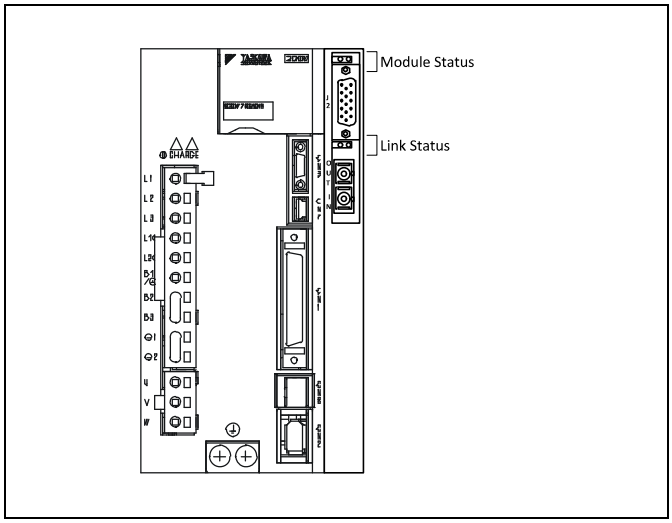


Figure 13: ACC-85M Status Indicators

Link Status LED

The green LED illuminates when the MACRO signal is present. The red LED is lit when the MACRO signal is not present. This provides a quick check for received signal from device located immediately upstream from ACC-85M on MACRO ring.

MODULE STATUS LED

This green LED illuminates to indicate that the module is operating correctly in the ACC-85M. This indicator flashes when the module is in the MACRO-ASCII mode.

Table 10: Module Status LED Descriptions

GREEN LED	RED LED	Status Description
Off	Off	No ring activity. No Failure.
Blink	Off	Module is in ASCII Mode. No failure
On	Off	Module operating normally. No failure
Off	On	No ring activity. Hard Failure (may need to cycle power)
Blink	On	No ring activity. Hard failure (may need to cycle power)
On	Blink	Module has resettable error (try CLRF to clear error)

ACC-85M Faults Displayed on Yaskawa SERVOPACK

The following table, lists the codes which are displayed on Yaskawa SERVOPACK 7-segment display upon detection of a fault in ACC-85M option module.

These faults are cleared if the MACRO Master sends a command to clear the faults (“CLRF” or “MSCLRFn”). Error code 0EA0 requires a power cycle to clear.

If after a “CLRF” the fault still exists, the Yaskawa SERVOPACK display will show the fault code again.

Table 11: ACC-85M Faults Displayed on Yaskawa SERVOPACK

CODE	DESCRIPTION	NOTES
0A0B	MACRO Ring Break	Check the physical MACRO ring connection
0A0D	Ring Data Fault	Not enough SYNC packets or too many data packet errors. Check MI8, MI9 and MI10 settings
0A0F	Prior ring station transmitting a RING BREAK Duplicate station node address error.	Check the device upstream of ACC-85M for any errors Check MI996 of all stations versus I6841 of controller
0EA0	Command option module alarm	Must cycle power to clear.
0EA2	Amplifier Watchdog error	Amplifier not responding to ACC-85M option module.
0EA3	Checksum Error (memory transfer error)	DPRAM checksum error from amplifier.
0EA4	AMP not enabling	ENA timeout error. Check Yaskawa SERVOPACK.

Special mi-Variables for macro interface

The following MI-variables are specifically designed for the uMACRO interface associated with the Yaskawa SGDV SERVOPACK Command Option ACC-85M.

Table 13: Special MI-Variables For Macro Interface

MI-VAR	DESCRIPTION	DEFAULT	SAVED PARAM
MI30	Control Mode Select (2:Speed Control 3: Torque Control)	2	*
MI31	P/PI toggle Request (V_PPISel)		
MI32	CLR Request for position integration (ClrPosIntg)		
MI33	Select bank (gain) parameter (BankSel)		
MI34	Sensor on request (SensOn)	1	*
MI35	Magnetic pole detection start request (PolDet)		*
MI36	Break signal release request (BrkRelease)		
MI37	(2-bits) D0 - Positive torque limit enabled D1 - Negative torque limit enabled	00	*
MI38	(2-bits) D0 – Positive software overtravel D1 – Negative software overtravel	00	*
MI39	Encoder Latch (Latch) 8-bits D0 SelEncCphs Select C phase latch position encoder D1 SelEncExt1 Select latch position encoder Ext1 D2 SelEncExt2 Select latch position encoder Ext2 D3 SelEncExt3 Select latch position encoder Ext3 D4 RqCPhs Latch request of C phase input position D5 RqExtSig1 Latch request of Ext1 input position D6 RqExtSig2 Latch request of Ext2 input position D7 RqExtSig3 Latch request of Ext3 input position	1 0 0 0 1 0 0 0	*
MI40	Reserved		
MI41	Select Monitor 1 (MonSel1) (8-bit address) (Sets MI920 monitor value)	$30 (HM)	*
MI42	Select Monitor 2 (MonSel2) (8-bit address) (Sets MI921 LSB monitor Value)	$0E (ABS)	*
MI43	Select Monitor 3 (MonSel3) (8-bit address) (Sets MI921 MSB monitor Value)	$0F (ABS)	*
MI44	Select Monitor 4 (MonSel4) (8-bit address) *(uses monitor table values)*	$3B (Alarms)	*
MI45	Select Monitor 5 (MonSel5) (8-bit address)		*
MI46	Select Monitor 6 (MonSel6) (8-bit address)		*
MI47	Select Monitor 7 (MonSel7) (8-bit address)		*
MI48	Select Monitor 8 (MonSel8) (8-bit address)		*
MI49	Reserved		
MI50	FB position counter (FbPosition)		
MI51	Monitor Data 1		
MI52	Monitor Data 2		
MI53	Monitor Data 3		
MI54	Monitor Data 4		
MI55	Monitor Data 5		
MI56	Monitor Data 6		
MI57	Monitor Data 7		
MI58	Monitor Data 8		

MI59	Control Status (16-bit) D1-D0 SELMOD 0: Cntrl Disabled 1:Position 2:Speed 3:Torque D2 COIN Positioning completed D3 MotMoving Motor rotating/traveling D4 ReachVelCmd Velocity reached D5 SpdClamped Speed being clamped D6 TrqClamped Torque being clamped D7 OpEnabled Motor drive state of option card D8 SafetyStop Safety stop state D9-D15 Not defined		
MI60	Sequence Status (16-bit) D0 Alarm Alarm status D1 Warning Warning status D2 AlmRstComp Alarm reset completed D3 D4 SvOnComp Servo-on completed D5 SensOnComp Sensor-on completed D6 PolDetComp Magnetic pole detection completed D7 BrkReleased Break is released D8 MainPowerOn Main circuit power-on D9 SvReady Servo ready D10-D15 Not defined		
MI61	SelMon1 Select Monitor 1		
MI62	SelMon2 Select Monitor 2		
MI63	SelMon3 Select Monitor 3		
MI64	SelMon4 Select Monitor 4		
MI65	SelMon5 Select Monitor 5		
MI66	SelMon6 Select Monitor 6		
MI67	SelMon7 Select Monitor 7		
MI68	SelMon8 Select Monitor 8		
MI69	Latch Status (8 LSBs) D0 CPhsRqLvl C phase latch request level D1 ExtSig1RqLvl Ext1 Latch request level D2 ExtSig2RqLvl Ext2 Latch request level D3 ExtSig2RqLvl Ext3 Latch request level D4 CphsComp C phase latch completed D5 ExtSig1Comp Ext1 latch completed D6 ExtSig2Comp Ext2 latch completed D7 ExtSig3Comp Ext3 latch completed		
Not a MIxx parameter Located in MACRO node flag register (reg. 3)	Input Signals (8 MSBs) MACRO node flag bit DEC Input DEC signal status D16 P_OT Input P-OT signal status D17 N_OT Input N-OT signal status D18 EXT1 Input EXT1 signal status D19 EXT2 Input EXT2 signal status D20 EXT3 Input EXT3 signal status D21 HBB Input HBB signal status D22 not defined D23		

MONITOR PARAMETER TABLE

The following tables list the parameters which may be assigned to the MI41 – MI48 variables.

Table 14: High Speed Parameter Table (Cyclical Values)

<table>
<tr><th>MonSel Code</th><th>FUNCTION</th><th>UNITS</th><th>COMMENTS</th></tr>
<tr><td>00h</td><td>Motor FB Speed</td><td>OS/1000000h</td><td></td></tr>
<tr><td>01h</td><td>Reference Speed Command</td><td>OS/1000000h</td><td></td></tr>
<tr><td>02h</td><td>Reference Torque Command</td><td>max torque / 1000000h</td><td></td></tr>
<tr><td>03h</td><td>Position Error (last 32 bits)</td><td>Reference Unit</td><td>(Unused mode) for Position control</td></tr>
<tr><td>04h</td><td>Position Error (first 32 bits)</td><td>Reference Unit</td><td>(Unused mode) for Position control</td></tr>
<tr><td>0Ah</td><td>PG Count data (last 32 bits)</td><td>Reference Unit</td><td>Motor PG Position</td></tr>
<tr><td>0Bh</td><td>PG Count data (first 32 bits)</td><td>Reference Unit</td><td>Motor PG Position</td></tr>
<tr><td>0Ch</td><td>FPG Count data (last 32 bits)</td><td>Reference Unit</td><td>Fully Closed PG Position</td></tr>
<tr><td>0Dh</td><td>FPG Count data (first 32 bits)</td><td>Reference Unit</td><td>Fully Closed PG Position</td></tr>
<tr><td>0Eh</td><td>FB Position (last 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>0Fh</td><td>FB Position (first 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>30h</td><td>C-Phase latch position (last 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>31h</td><td>C-Phase latch position (first 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>32h</td><td>EXT1 Latch position (last 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>33h</td><td>EXT1 Latch position (first 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>34h</td><td>EXT2 Latch position (last 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>35h</td><td>EXT2 Latch position (first 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>36h</td><td>EXT3 Latch position (last 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>37h</td><td>EXT3 Latch position (first 32 bits)</td><td>Reference Unit</td><td></td></tr>
<tr><td>38h</td><td>Virtual position error</td><td>Reference Unit</td><td></td></tr>
<tr><td>39h</td><td></td><td></td><td></td></tr>
<tr><td>3Ah</td><td>Input Signal State
<table>
<tr><th>BitNo</th><th>Name</th><th></th></tr>
<tr><td>D0</td><td>SI0</td><td>SI0 Port input</td></tr>
<tr><td>D1</td><td>SI1</td><td>SI1 Port input</td></tr>
<tr><td>D2</td><td>SI2</td><td>SI2 Port input</td></tr>
<tr><td>D3</td><td>SI3</td><td>SI3 Port input</td></tr>
<tr><td>D4</td><td>SI4</td><td>SI4 Port input</td></tr>
<tr><td>D5</td><td>SI5</td><td>SI5 Port input</td></tr>
<tr><td>D6</td><td>SI6</td><td>SI6 Port input</td></tr>
<tr><td>D7</td><td>SI7</td><td>SI7 Port input</td></tr>
<tr><td>D8 – D23</td><td>-</td><td>Reserved</td></tr>
<tr><td>D24</td><td>HWBB1</td><td>Hardwired Base Block Input 1</td></tr>
<tr><td>D25</td><td>HWBB2</td><td>Hardwired Base Block Input 2</td></tr>
<tr><td>D26</td><td>STOP1</td><td>Safety Option Card Inp1</td></tr>
<tr><td>D27</td><td>STOP2</td><td>Safety Option Card Inp2</td></tr>
<tr><td>D28</td><td>STOP3</td><td>Safety Option Card Inp3</td></tr>
<tr><td>D29</td><td>STOP4</td><td>Safety Option Card Inp4</td></tr>
<tr><td>D30</td><td>EDM2</td><td>Safety Option Card Out2</td></tr>
<tr><td>D31</td><td>EDM3</td><td>Safety Option Card Out3</td></tr>
</table></td><td></td><td>SI0 – 7:
Open(H) : 1
Close(L) : 0

STOP 1 – 4:
EDM 2 – 3:
HWBB 1 – 2:
Open(H) : 1
Close(L) : 0

STOP1~4, EDM2 and EDM3 are effective only when Safety option card is connected to servo unit.</td></tr>
<tr><td>3Bh</td><td>Alarm/Warning Code</td><td></td><td>Alarm Code (Last 16 bits)
Warning Code (First 16 bits)</td></tr>
</table>

Table 15: Low Speed Parameter Table (Non-Cyclical Values)

MonSel Code	FUNCTION	UNITS	COMMENTS
10h	Actual Speed	Rotary (min^{-1}) Linear (mm/s)	Un000
11h	Commanded Speed (Speed control)	Rotary (min^{-1}) Linear (mm/s)	Un001
12h	Internal Torque Command	%	Un002
13h	Number of pulses from origin	Pulse	Un003
14h	Angle from origin point	Deg	Un004
15h	Input Signal Monitor		Un005
16h	Output Signal Monitor		Un006
17h	Speed (Set by position command)	Rotary (min^{-1}) Linear (mm/s)	Un007
18h	Position Command Error Counter	Reference Unit	Un008
19h	Accumulated Load Factor	%	Un009
1Ah	Regenerative Load Factor	%	Un00A
1Bh	DB Resistance Power Consumption	%	Un00B
1Ch	Input Command Pulse Counter	Pulse	Un00C
1Dh	Feedback Pulse Counter	Pulse	Un00D
1Eh	Fully-Closed Feedback Pulse Cntr	Pulse	Un00E
22h	Total Work Time	100mS	Un012
23h	Multi-turn data of absolute encoder after “Sensor On” request	Rotation	Rotary Motor Only
24h	Initial Incremental PG Count	Pulse	Rotary Motor Only
25h	Position data of absolute encoder after “Sensor On” (last 32 bits)	Scaling Unit	Linear Motor Only
26h	Position data of absolute encoder after “Sensor On” (forst 32 bits)	Scaling Unit	Linear Motor Only

CONNECTOR PINOUTS

All interface signals appear at the front panel of this accessory card.

SC-Style Fiber Interface Connector – MACRO Comms (OPT-A)

This is the fiber optic MACRO interface connector.

RJ-45 In and Out Interface Connector – MACRO Comms (OPT-C)

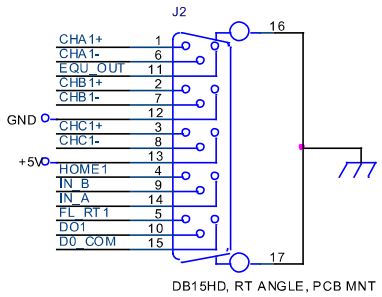
These are the wired MACRO interface connector.

Connector J2 – Interface Signals for Accessory card

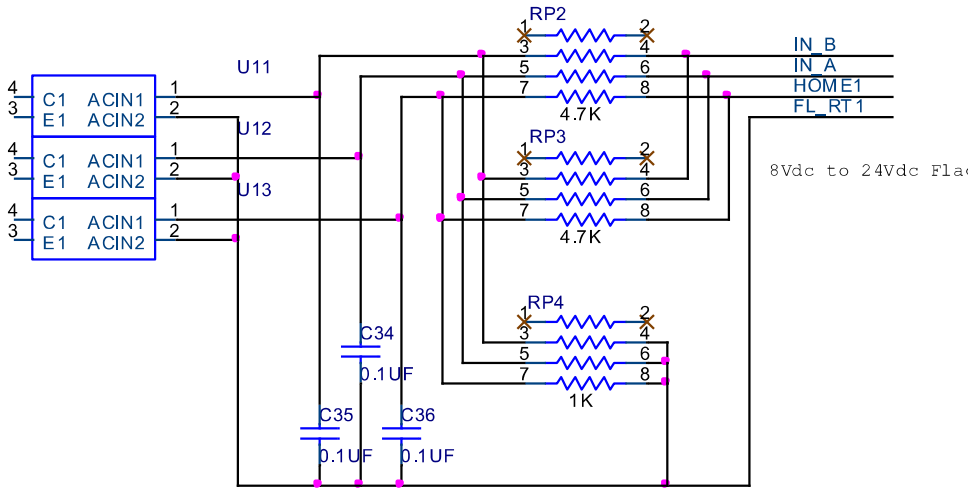
This is a high density DB15S DSUB connector. The user needs a to supply a mating connector.

Pin#	Signal Name	Type	Description
1	CHA+	INPUT	Secondary encoder input
2	CHB+	INPUT	Secondary encoder input
3	CHC+	INPUT	Secondary encoder input
4	HOME	INPUT	Flag_A
5	FL_RET	INPUT	RET for flags
6	CHA-	INPUT	Secondary encoder input
7	CHB-	INPUT	Secondary encoder input
8	CHC-	INPUT	Secondary encoder input
9	IN_B	INPUT	Flag_C
10	DOUT	Open Collector	User-defined output
11	EQU	TTL	High Speed TTL output
12	GND	POWER	Digital Ground
13	+5Vdc	POWER	Encoder Power (supplied from accessory card)
14	IN_A	INPUT	Flag_B
15	DO_COM	Open Collector Return	User-defined output Return

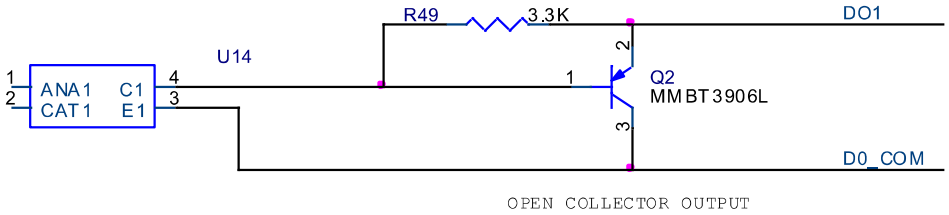
Connector J2 Diagram



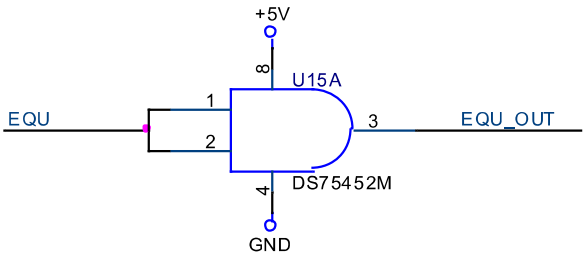
User Inputs Circuit Diagram



User Output Circuit Diagram



High Speed TTL Outputs Circuit Diagram



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