EBC

Encoder Back-Up Compensator

OPERATION MANUAL
EBC001b

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GENERAL DESCRIPTION

1.1 GENERAL DESCRIPTION

ORMEC's Encoder Back-up Compensator (EBC) provides an effective method for interfacing Programmable Motion Controller (PMC) based positioning systems with machine motion which is not under servo control. It mounts directly to a PMC as a "daughter board" without requiring an additional slot in the PMC chassis.

The EBC accepts quadrature signals directly from an incremental position encoder mounted to the equipment whose motion the PMC is to follow. The EBC processes the encoder quadrature, decoding each transition of the quadrature signals (4x multiplication) and provides a single pulse train which can be used by PMCs as an external motion reference for the "motion reference bus".

Should the equipment whose motion is being monitored by the EBC back up, the EBC measures the amount of the reversal, up to 4095 encoder transitions. Motion reference bus pulses are not transmitted by the EBC until the equipment has gone forward to the point where it started to back up. This capability allows the PMC based positioning system to accurately track external equipment during start-stop and machine vibration conditions.

Also provided on the EBC is an LSI counter-timer integrated circuit which can be used for high accuracy application specific requirements and integrated into the operation of the PMC with special purpose MPL commands designed by ORMEC.

One can see that the EBC processes the signals from an encoder monitoring machine motion and transmits "net forward distance" to be used on the motion reference bus. Because of this, it is only useful for machines that are not supposed to have their PMC based systems tracking the machine under back-up conditions.

1.2 APPLICATION EXAMPLE

An example of an application of using the EBC in conjunction with a PMC based position control system is detailed below:

Conveyor Application: Suppose an existing conveyor system has a requirement for a flexible position controller that can operate in coordination with it even though the conveyor operates at variable speeds. By using a PMC equipped with an EBC, the motion of the servomotor operated by the PMC can be programmed in terms of:

distance - counts of travel of the PMC based servomotor as defined by its position encoder

velocity - speed of operation of the PMC based servomotor is defined in terms of its encoder travel as a percentage (0.00 to 100.00%) of the pulse rate from the position encoder attached to the EBC

acceleration - acceleration of the PMC based servomotor is defined in terms of distance traveled by the encoder attached to the EBC

Example: Assume a compartment-oriented conveyor is operating at a constant, but variable, speed to move finished parts from a manufacturing system. A servomotor is attached through a ballscrew to a table which is positioned along side of the moving conveyor. Parts are placed on the table by the manufacturing machine as they are completed, and it is the job of the PMC based motion control system to transfer the part into the next open compartment of the conveyor as it goes by.

Two sensors are placed at the conveyor. The first senses the approach of each compartment and the second senses whether or not the compartment is full. These sensors are tied into the PMC as Machine I/O Inputs 1 and 2. An encoder is attached to the conveyor and interfaces to the EBC. The encoder has a resolution of 0.001" per count (1000 counts per inch). The encoder on the table system has the same resolution. The PMC controlling the servomotor is configured as a "motion bus slave", which means that its motion will be referenced to the external "motion reference bus" which is driven by the EBC. This information is actually the distance traveled by the conveyor system. The MPL program to control this application reads as follows:

@Setup	@S marks the beginning of the "Setup" program (program "S")
SX42	configure the PMC as a motion bus slave with + & - limits
I20000	set the transfer distance (table travel) to be 20.000"
A5	set accel distance to 5 hundred counts (.5") of conveyor travel
V100.00	set the transfer velocity to be 100.00% of the conveyor speed
@Run	@R marks the beginning of the "Run" program (program "R")
U1	wait Until Input 1 goes "high" signifying compartment arrival
BR2	Branch back to beginning of "Run" if the compartment is full
I+	Index positive for the transfer distance
D10;	Delay 10 milliseconds after reaching top speed
O1	Turn on output 1 to cause the transfer
D500	Delay .3 seconds for the transfer to take place
O0	Turn off output 1
D,	Delay until the motion is stopped
G0	Go back to the "load position" to get another part
D,	Delay until the table is in the load position
E	Exit this routine

Each time this routine is executed, it will move the table at the same speed as the continuously moving conveyor and transfer one part from the table to the next empty compartment.

SPECIFICATIONS

2.1 GENERAL SPECIFICATIONS

Power	EBC is powered from the PMC +5V 100 mA (max) ±12V 20 mA (max)
Environment	0-60°C, 0-90% relative humidity
Size	4.0" x 6.55"

2.2 MATING CONNECTORS

10 pin Molex Housing	Crimp & Insert	MOLEX 22-01-3107
12 pin Molex Housing	Crimp & Insert	MOLEX 22-01-2127

INSTALLATION

3.1 BOARD INSTALLATION INSTRUCTIONS

The EBC is designed to interface with ORMEC's Programmable Motion Controller and mounts as a "daughter board" on the PMC. The EBC is connected both through the PMC's JM4 header connector and the socket of U16.

The following instructions describe how to mount the EBC on a PMC. Refer to Appendix 4.2 for more information.

- Remove panhead screws from the nylon standoffs on the underside of the EBC.
- Remove the jumper from JM4 Pins 25 & 26 on the PMC.
- Remove the chip from U16 position on the PMC.
- Mount EBC on PMC, carefully aligning the header connections. The EBC's JF14 female header connector is mounted on the PMC's JM4 male header connector. The EBC's JM13 male header connector is mounted on the PMC's U16 socket.
- Next, pan-head screws are inserted into the nylon standoffs from the underside of the PMC to secure the "daughter board" in place.
- Now, remove the jumper on pins 1 & 2 of JM20. JM20 is in the upper right hand corner of the PMC, directly below the Serial Communications Interface. If you hold the board with the connectors across the top edge of the board, pins 1 & 2 are the pins closest to the top edge of the pc board. Remove this header, and you're ready for normal EBC operation.

3.2 FIELD INSTALLATION INSTRUCTIONS

To complete the installation of the EBC, the quadrature signals of the master encoder must be connected to connector JM12. See the EBC Function Diagram in Appendix 4.3 for details. The two encoder "phase quadrature signals" are named EBCA and EBCB. Also provided are inverted inputs for use with encoders utilizing differential line drivers. They are named EBCA' and EBCB' respectively. If not available because the encoder does not have differential outputs, these signals may be either left open or grounded. Connections are also provided for the once per revolution encoder reference signal, EBCR and its inversion EBCR'.

Power (+5 vdc) and common are provided at connector JM12 for use by the EBC position encoder as is a tie point for the cable shield.

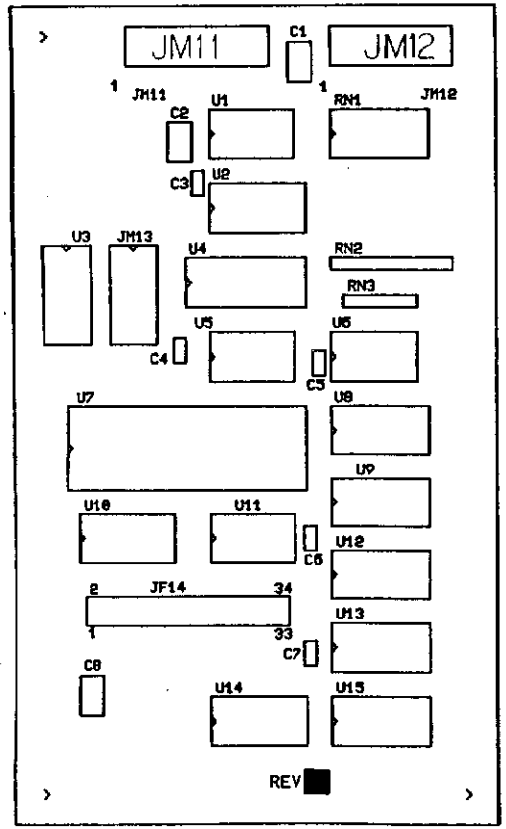
Any other connections to either JM12 or JM11 are application specific, and will be explained on an individual application basis.

3.3 INITIALIZATION FIRMWARE

For all MPL versions up to and including MPL2x2h, EBC initialization is not included, and an additional "Extended Firmware Set", XFS002 must be inserted in location U62 of the PMC. For all versions starting with MPL2x2i, EBC initialization is automatically done if the board is present, and no additional firmware is required.

SIZE	DRAWING IDENTIFICATION	REV	SHEET	OF
B	E B C Ø Ø 4	A	1	1

GENERAL I/Ø ENCODER INTERFACE

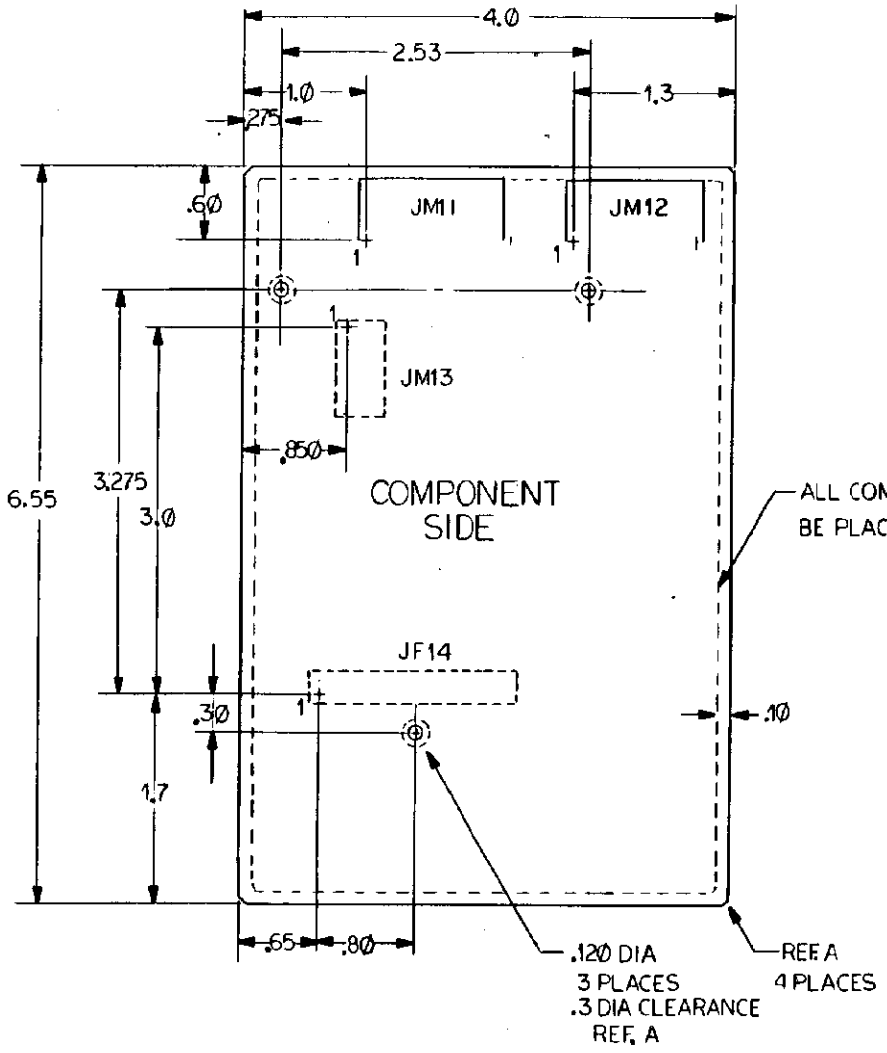


APPENDIX 4.1

ORMEC SYSTEMS CORP

DATE 3-11-85	ENCODER BACKUP COMPENSATOR
DRAWN	COMPONENT LAYOUT
APPROVED	SIZE B · DRAWING IDENTIFICATION E B C Ø Ø 4 · REV A · SHEET 1 · OF 1

SIZE	DRAWING IDENTIFICATION	REV	SHEET	OF
B	E B C Ø Ø 2	B	1	1

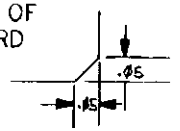


ALL COMPONENTS AND TRACES TO BE PLACED WITHIN DOTTED LINE

NOTES:
1. TOLERANCES
.XX ± .020
.XXX ± .005

DO NOT SCALE DRAWING

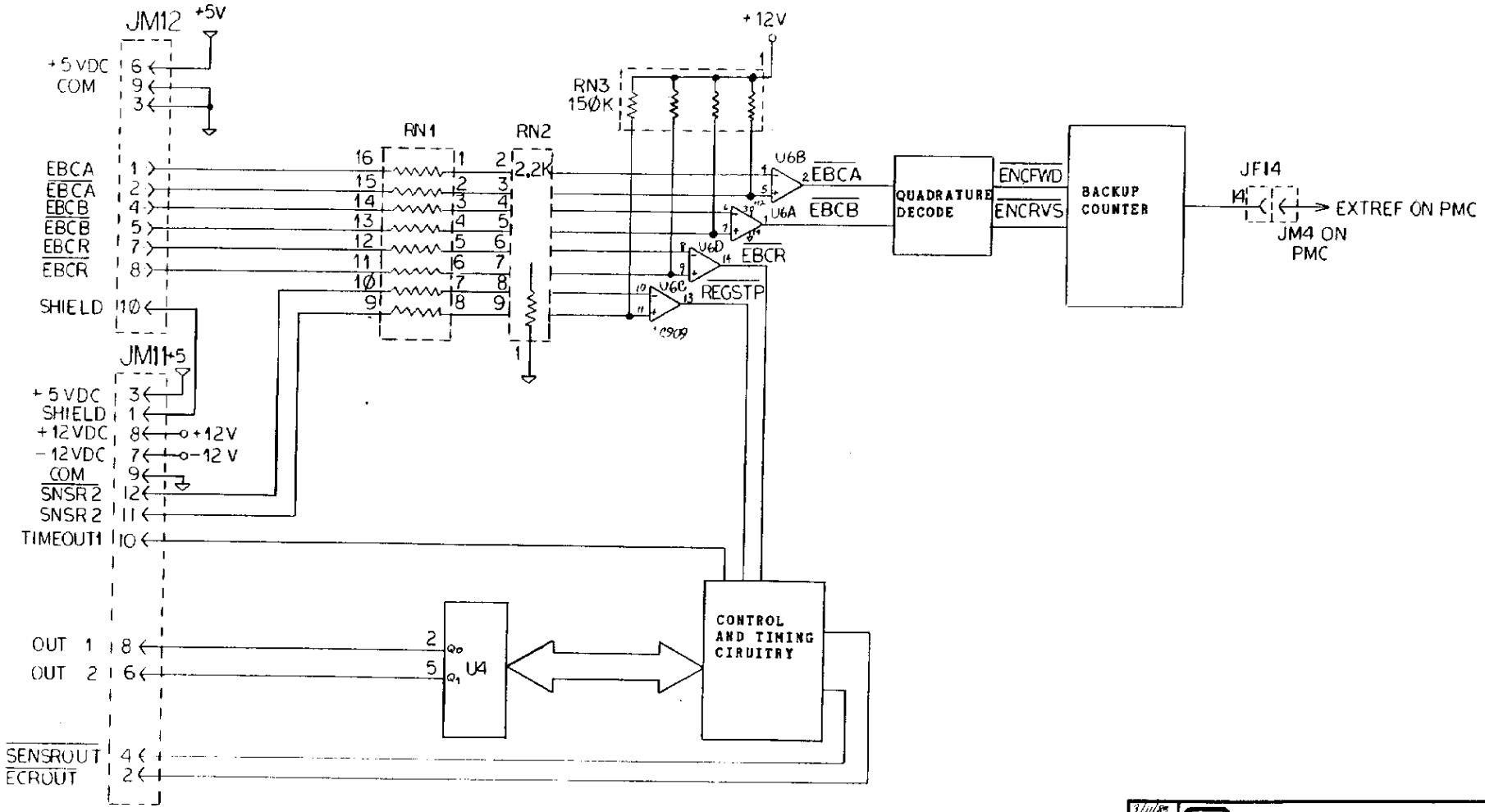
CORNER OF PC BOARD



APPENDIX 4.2

DATE 10-1-84	ORMEC SYSTEMS CORP	
DRAWN	ENCODER BACKUP COMPENSATOR	
APPROVED	P.C. BOARD LAYOUT	
	SIZE B	DRAWING IDENTIFICATION E B C Ø Ø 2 REV B SHEET 1 OF 1

SIZE	DRAWING IDENTIFICATION	REV	SHEET	OF
B	EBC003	A	1	1



APPENDIX 4.3

ORMEC SYSTEMS CORP

DATE	11-19-84	EBC-FUNCTION DIAGRAM				
DRAWN						
APPROVED		SIZE	DRAWING IDENTIFICATION	REV	SHEET	OF
		B	EBC003	A	1	1