
Autotech Controls
M7350 CBusModule
Resolver Shut Height Indicator
Instruction & Operation Manual



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M7350 CBusModule Resolver Shut Height Indicator (RSHI), ASY-M7350-RSHI

1. Introduction

The M7350 Resolver Shut Height Indicator (RSHI) Module communicates with the programmable logic controller (PLC) through input and output registers. The module's input registers read coarse position, fine position, and I/O status. The output registers allow you to program module parameters.

Autotech's human factors engineering has made it possible to program all M7350 RSHI module functions through the PowerPanel or PLC interface module. The M7350 RSHI module communicates with AVG's multi-function PowerPanel through 2048 16-bit registers. These registers can be user mapped to monitor and configure the module functions. AVG's μ WIN[®] Software allows the user to interface the data from the module into user-defined graphic screens.

The M7350 system can store up to 500 die-set programs. During die changeover, the operator can enter a particular die number or choose die by selecting the name, and after start can initiate the automatic positioning sequence. The M7350 RSHI senses the die position and adjusts the shut height to the preprogrammed position. An automatic anti-backlash routine is built into the die-set program so that the shut height motor will always approach the programmed position from the same direction. For better precision, a programmable coasting distance (correction factor) may be entered for each die so that the control motor will shut off in time to allow the die to coast to a stop at the desired shut height. For maximum precision, the motor can be pulse width modulated starting at the distance equal to correction factor above the programmed position.

The M7350 RSHI module offers Broken Wire Detection and Drift Limit Detection through an I/O Status Word.

Broken Wire Detection

The Broken Wire I/O Status Bit is normally energized when the M7350 RSHI module is operating normally and the resolver wiring is intact. If one or more of the resolver wires are broken or disconnected, the I/O status bit will de-energize.

Drift Limit Detection

When die position is beyond the programmed position, plus or minus the drift limit, this bit is de-energized.

The following information required for M7350 RSHI operation includes press-specific and die-specific parameters.

Press Specific Parameters include:

- Die Number selected
- Scale Factor, automatically computed in calibration mode
- Upper Safety Limit
- Lower Safety Limit
- Drift Limit
- Two Calibration Points for automatic calibration

Die Specific Parameters include:

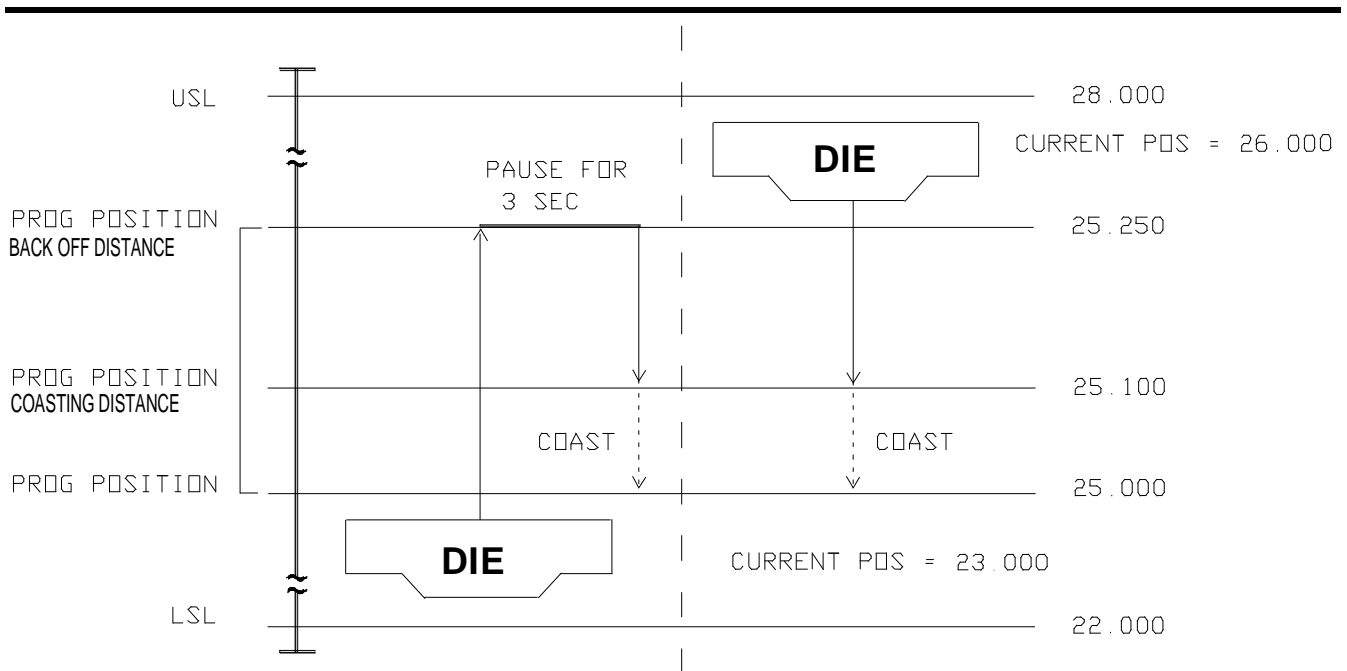
- Die Number
- Die Name, 8 alphanumeric characters
- Programmed Position
- Correction Factor

To understand automatic die-set function, read the following examples and refer to diagram below .

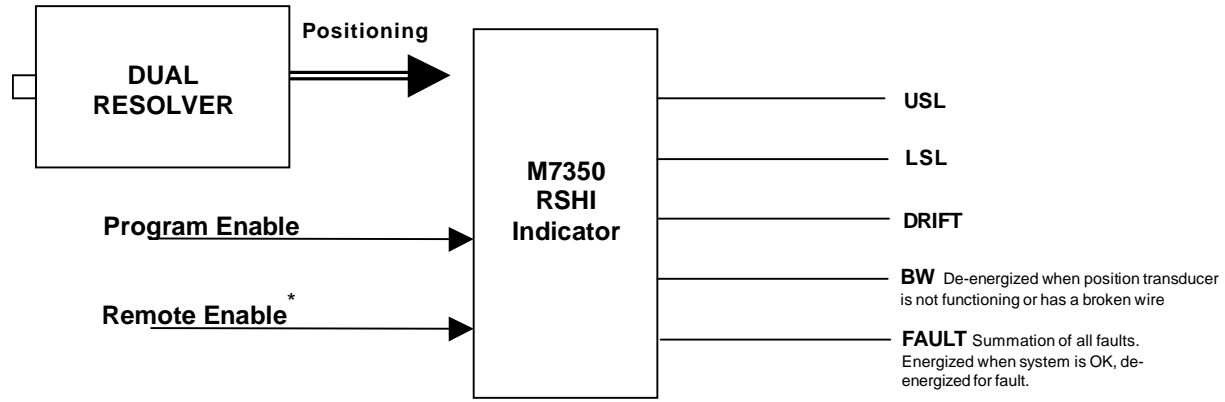
Example 1 (die lower than programmed position):
 If the Programmed Die-Set Position is 25.000 inches, and the current die position is physically too low, the die will be moved the back off distance (about .25 inch) above the programmed position, pause for 3 seconds, and then descend to the die-set position. If pulse high and low times are programmed as zeroes, the motor will be turned off at programmed position plus coasting distance (correction factor). It will then coast until it comes to a full stop. If

pulse times are other than zeroes, the motor will be pulsed according to the programmed parameters starting at programmed position plus coasting distance. When programmed position is reached, pulsing stops.

Example 2 (die higher than programmed position):
 If the die begins in a position more than 1/4 inch too high, then only the second part of the positioning sequence will be executed (the part following the pause).

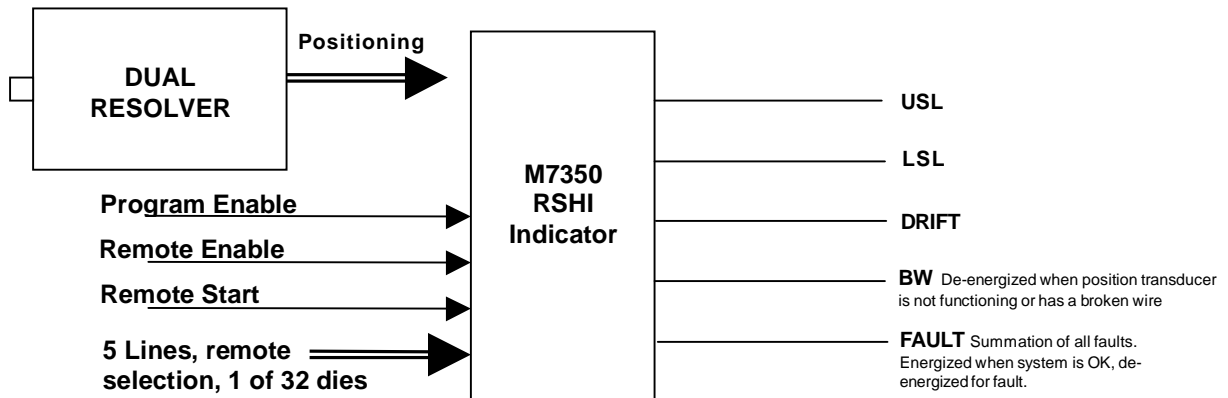


M7350 RSHC Module with A120 Modicon Cradle



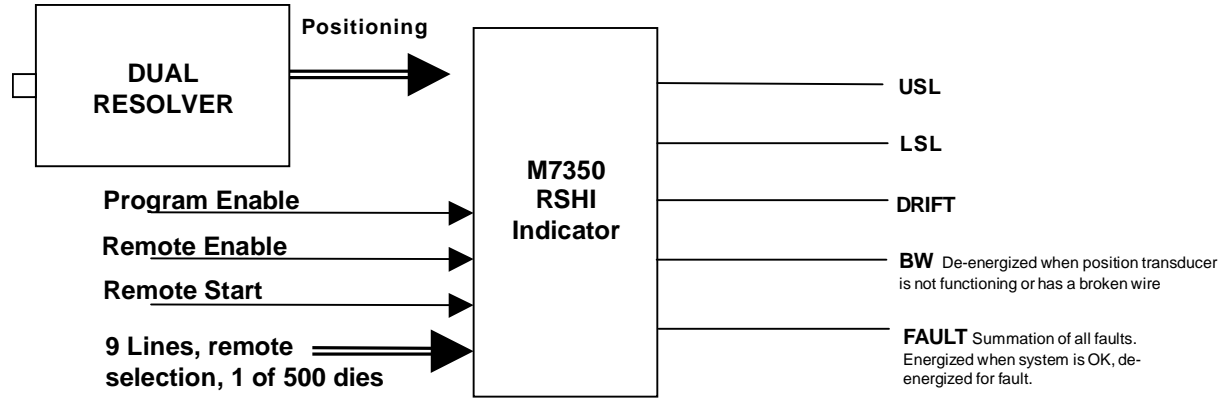
* should always be disabled

M7350 RSHC Module with the Quantum Module Cradle/MF1 Cradles/MF2 Cradles



When the M7350 RSHC Module is used with the A120, Quantum, MF1, and MF2 cradles, it is not possible to access remotely each of the 500 dies, but that function is always available by programming through the use of registers.

M7350 RSHI Module with the MF5 Cradle



Decimal Address: 132

I/O Status (16 Bit)

MSD												LSD			
X	X	X	X	X	X	DL	NM	X	X	X	X	X	X	RE	PE

X = Not Used

PE = Program Enable
 0 = No input
 1 = Input

RE = Remote Enable
 0 = No input
 1 = Input

BW = Broken Wire
 0 = Broken Wire Fault
 1 = No Broken Wire Fault

NM = No Motion Fault
 0 = No Fault
 1 = No Motion Detected

DL = Drift Limit
 0 = Programmed position is within drift limit
 1 = Programmed position exceeds drift limit

MSD = Most significant digit
 LSD = Least significant digit

Decimal Address: 134

Outputs (16 Bit)

MSD									LSD						
X	X	X	X	X	X	X	X	X	FLT	BWF	DLF	LSL	USL	MD	MU

X = Not Used

MU = Motor Up Command
 1 = Move

MD = Motor Down Command
 1 = Move

USL = Upper Safety Limit Fault
 0 = Over safety limit
 1 = Under safety limit (OK)

LSL = Lower Safety Limit Fault
 0 = Under safety limit
 1 = Over safety limit (OK)

DLF = Drift Limit Fault
 0 = Programmed position exceeds + or - drift limit
 1 = Programmed position within drift limit

BWF = Broken Wire Fault
 0 = Broken wire detected
 1 = No broken wire fault

FLT = Fault (summation of USL, LSL, Drift, BW and No Motion Faults)
 0 = Fault detected
 1 = No fault selected

2. Specifications

Input Power: 24 VDC @ 100 mA

Operating Temperature: -10 to +130° F (-23 to +55° F)

Position Output Format: BINARY

Position Resolution:

Update Time:

Programmable Parameters:

- Drift Limit
- Die Number
- Die Name
- Programmed Position
- Correction Factor
- Upper Safety Limit
- Lower Safety Limit

Discrete I/O:

Inputs

Program Enable

Outputs

- Upper Safety Limit Fault
- Lower Safety Limit Fault
- Drift Limit Fault
- Broken Wire Fault
- System Fault

Resolver Type:

I/O Electrical Specifications

Customer supplied 24V power Vs+, Vs-: 20 to 30VDC @ 100 mA + current used by user's loads and inputs.

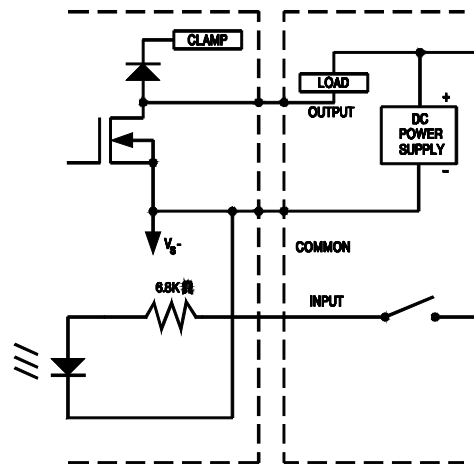
N-Channel Sinking Output

OUTPUT LOGIC LEVELS:

- Logic True:** MOSFET On, .2V Max @ 100 mA
- Logic False:** MOSFET Off, .05 mA leakage @ 30V
- Max. Current per Output:** 600 mA
- Max. Current per Card:** 2 Amps
- Output Isolation:** 1500V

INPUT LOGIC LEVELS (P-TYPE SOURCING):

- Logic True:** 6–30 VDC
- Logic False:** 0–1.5 VDC
- Input Isolation:** 1500 V



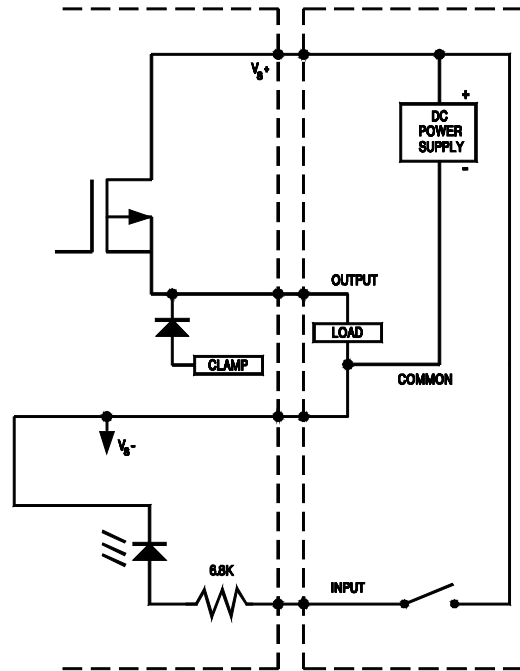
P-Channel Sourcing Output

OUTPUT LOGIC LEVELS:

- Logic True: MOSFET On, .5V Drop @ 100 mA
- Logic False: MOSFET Off, .05 mA leakage @ 30V
- Max. Current per Output: 600 mA
- Max. Current per Card: 2 Amps
- Output Isolation: 1500 V

INPUT LOGIC LEVELS (P-TYPE SOURCING):

- Logic True: 6–30 VDC
- Logic False: 0–1.5 VDC
- Input Isolation: 1500 V



3. Module Functions

Parameter	Definition	Range
Drift Limit		0.000 to 0.250 Default: 0.000
Die Number		1 to 500
Die Name		Limited to 8 ASCII characters
Programmed Position		Must be in the range: Upper Safety Limit (0.250) to Lower Safety Limit (0.000)
Correction Factor		Must be less than Back Off Distance

4. Memory Map

Location	Register Definitions	Location	Register Definitions
<u>Read Only Area</u>			
0x0080	Read Current Position Whole part of position value, range 0-999	0x038C	R/W Destination Tool Number
0x0082	Fractional part of position value, range 0-999	0x038E	R/W Programmed Position (whole part)
0x0084	Read I/O Status I/O status word	0x0390	R/W Programmed Position (fractional part)
	b0 Program Enable (PE) input	0x0392	R/W Correction Factor
	b1 Remote Enable. Enables Die ID inputs	0x0394	R/W Scale Factor (whole part)
	b2-b7 not used	0x0396	R/W Scale Factor (fractional part)
	b8 Broken Wire indication	0x0398	R/W Offset 1 (whole part)
	b9 not used	0x039A	R/W Offset 1 (fractional part)
	b10 Drift Limit Error. Detected when ram position is beyond Programmed Position +/- Drift Limit	0x039C	R/W Offset 2 (whole part)
	b11-b15 not used	0x039E	R/W Offset 2 (fractional part)
0x0086	Read Outputs Shut Height Controller output state	0x03A0	R/W Active Tool Name (character 1, 2)
	b0 not used	0x03A2	R/W Active Tool Name (character 1, 2)
	b1 not used	0x03A4	R/W Active Tool Name (character 1, 2)
	b2 Upper Safety Limit ON=OK	0x03A6	R/W Active Tool Name (character 1, 2)
	b3 Lower Safety Limit ON=OK		
	b4 Drift Limit Fault ON=OK		
	b5 Broken Wire Fault ON=OK		
	b6 Fault as a summation of all faults (ON=OK): Upper Safety Limit FAULT, Lower Safety Limit FAULT, Drift Limit FAULT,		
	b7-b15 not used		
0x009E	Read Mode Status		
<u>Write Only Area</u>			
0x00A0	Write Mode Control		
0x00B8	Write Calibration Point 1 (whole part)		
0x00BA	Write Calibration Point 1 (fractional part)		
0x00BC	Write Calibration Point 2 (whole part)		
0x00BE	Write Calibration Point 2 (fractional part)		
<u>Read/Write Area</u>			
0x0102	R/W Active Tool Number		
0x0104	R/W Upper Safety Limit (whole part)		
0x0106	R/W Upper Safety Limit (fractional part)		
0x0108	R/W Lower Safety Limit (whole part)		
0x010A	R/W Lower Safety Limit (fractional part)		
0x010C	R/W Drift Limit		
0x0112	R/W Active Programmed Position (whole part)		
0x0114	R/W Active Programmed Position (fractional part)		
0x0116	R/W Active Correction Factor		
<u>Shared Area</u>			
0x0380	R/W Tool Command		
0x0382	R/W Tool Number		
0x0384	R/W Tool Name (character 1, 2)		
0x0386	R/W Tool Name (character 3, 4)		
0x0388	R/W Tool Name (character 5, 6)		
0x038A	R/W Tool Name (character 7, 8)		

Dual Port RAM Errors

When writing to dual port RAM, the following errors are defined:

- 0 No error
- 1 Remote control is ON, programming is not allowed
- 2 Value is out of range
- 3 Function module is busy
- 4 Program enable is not ON
- 5 Mode is invalid
- 6 Wrong calibration points setup

5 Programming

To use the M7350 RSHI module, you will typically go through the following steps:

PRESS SETUP

1. Set Lower and Upper Safety Limits.
2. Set first and second Calibration Points.
3. Calibrate Shut Height module.
4. Set Drift Limit.
5. Select Die Number.

DIE SETUP

1. Set Die Number.
2. Set Die Name.
3. Set Programmed Position.

Some of these parameters will have the following limitations and dependencies.

- Upper Safety Limit — must be larger than the Lower Safety Limit
- Lower Safety Limit — must be smaller than the Upper Safety Limit
- 1st Calibration Point — must be between Safety Limits
- 2nd Calibration Point — must be between Safety Limits
- Drift Limit — must in in the range 0.000 to 0.250
- Die Number — from 1 to 500, while module is in use with MF5 cradle , or from 1 to 32 while mdouel is in use with other cradles.
- Die Name — limited to 8 ASCII characters
- Programmed Position — must be in the range: Upper Safety Limit 0.250 to Lower Safety Limit
- Correction Factor — must be less than Back Off Distance

MODULE STATES

The M7350 RSHI can be in the following different states:

Module State	Read Mode Status register
READY	0x0001

MODULE STATES DESCRIPTION

READY

Module is ready for calibration.

Module State change is allowed by entering different commands to Write Mode Control register and new command perception occurs while register value transition takes place.

Command	Write Mode Control Register
STOP	0x0000
SET CALIBRATION POINT #1	0x0001
SET CALIBRATION POINT #2	0x0002

MODULE COMMANDS DESCRIPTION

The SET CALIBRATION POINT #1 command should be entered after the Die is moved to a position near one end of its travel, but still within the Safety Limits. Also known position value should already be placed in Write Calibration Point #1 registers.

The SET CALIBRATION POINT #2 command is required to finish calibration procedure. Die should be near the other end of its travel. At this moment Write Calibration Point 2 registers should contain information about actual position value. After calibration procedure, information about current scale factor, offset 1 and offset 2 is available, and can be provided on request in R/W Scale Factor, R/W Offset 1, and R/W Offset 2 registers.

STOP command forces the M7350 RSHI to be in the READY state.

PROGRAMMABLE INFORMATION IN THE SHARED AREA

Some of parameters related to press or die are assigned to shared area registers.

R/W Tool Command register bits can be set to execute the following commands:

	WRITE	LOCATION
Bit 0 – FIND	0x0001	0x0380 (R/W Tool Command)
Bit 1 – FIND_NEXT	0x0002	0x0380
Bit 2 – SELECT TOOL	0x0004	0x0380
Bit 3 – COPY TOOL	0x0008	0x0380
Bit 4 – WRITE TOOL	0x0010	0x0380
Bit 5 – DELETE TOOL	0x0020	0x0380
Bit 6 – READ TOOL	0x0040	0x0380
Bit 7 – READ CALIBRATION	0x0080	0x0380
Bit 8 – WRITE CALIBRATION	0x0100	0x0380

Only one bit is allowed to set at one time and will be cleared when the command is completed.

COMMANDS DESCRIPTION**FIND**

The function module will search the dies for the first one with a name that matches the name in the die name registers — **R/W Tool Name**. The search will start at die #1. Unused characters in the search name are treated as wildcards. For example, “TOM” will match “TOMMY”, or “TOMORROW”. The number and name of the matching tool will be placed respectively in the **R/W Tool Number** and **R/W Tool Name** registers. Also Programmed Position and Correction Factor values related to that die will be placed in the **R/W Programmed Position** and **R/W Correction Factor** registers. If no match is found then the **R/W Tool Number** register is set to zero. Also the **R/W Tool Name** and tool setup specific registers are filled with nulls (zeroes).

FIND_NEXT

The function module will search for the next die with a name that matches the search string entered in the last find command. The search will start at the tool number specified in the die number register **R/W Tool Number**. The number and name of the matching tool will be placed in the **R/W Tool Name** registers. Also Programmed Position and Correction Factor values related to that tool will be placed in the **R/W Programmed Position** and **R/W Correction Factor** registers. If no match is found then the **R/W Tool Number** register is set to zero. Also the tool name and tool setup specific registers are filled with nulls.

SELECT TOOL

The function module will select the tool with the name matching the name in the tool name register as active tool. If the name of the tool specified by the tool number register is the same as the name in the tool name register then that tool will be selected. Otherwise the function module will search for a tool with a matching name, starting at tool #1. If a match is found then that tool will become the active tool and its number and name will be placed in the tool number and tool name registers. Also Programmed Position and Correction Factor values related to that tool will be placed in the **R/W Programmed Position** and **R/W Correction Factor** registers. If match is not found then the active tool is not changed and tool number is set to zero. Also the tool name and tool setup specific registers are filled with zeros.

COPY TOOL

The function module will copy parameters set for the tool specified as a tool number in **R/W Tool Number**. Destination tool number is specified in the **R/W Destination Tool Number** register. The tool name for the destination tool will be set to spaces.

WRITE TOOL

The name, Programmed Position and Correction Factor for the tool number specified in the **R/W Tool Number** register will be changed to the name and the tool parameters in **R/W Tool Name**, and **R/W Programmed Position** registers. New value of Programmed Position is always compared against Upper Safety Limit – 0.250 and Lower Safety Limit as press specific parameters. Correction Factor must not be higher than current Back Off Distance value.

DELETE TOOL

The function module will delete the program specified by the **R/W Tool number** register and the **R/W Tool Name** registers. If the name of the tool specified in the **R/W Tool Number** register matches exactly the name in the **R/W Tool Name** registers then that tool will be deleted. A deleted tool parameters will be set to zeros and deleted tool name registers will be filled with nulls.

READ TOOL

The name for the tool specified in the **R/W Tool Number** will be placed in the **R/W Tool Name** registers. Also Programmed Position and Correction Factor related to specified tool will be placed in respective registers.

READ CALIBRATION

This command allows you to get actual press calibration parameters. Values of: Scale Factor, Offset 1, and Offset 2 will be placed in registers from **R/W Scale Factor** to **R/W Offset 2** (fractional part).

WRITE_CALIBRATION

This command is provided to set all parameters required for press calibration. After setting proper values press with its control module doesn't need to perform standard calibration procedure. Using that command one condition should be fulfilled: RAM must be in the same position as in the moment while **READ CALIBRATION** command was issued and calibration specific registers were memorized.

6 Wiring

CBus Signal Number	M7350 RSHI Function	CBus Backplane Pin	A120 Cradle Pin-out	PowerPanel FM Interface Pin-out
1	R1	12	21	J1-3
2	R2	14	22	J1-4
3	S3 Resolver	5	20	J1-4
4	S2 Resolver	7	19	J1-6
5	S1 Resolver	9	18	J1-7
6	S4 Resolver	11	17	J1-8
7	S3-2 Course Resolver	6	NC	J1-9
8	S2-2 Course Resolver	8	NC	J1-10
9	S1-2 Course Resolver	10	NC	J1-11
10	S4-2 Course Resolver	12	NC	J1-12
11	VS- (customer supplied power return)	15	2	J1-1/J1-2//J2-25
12	VS+ (customer supplied power)	18	1	J1-13
13	Up Output (on = move)	17	15	J1-14
14	Down Output (on = move)	19	14	J1-15
15	Upper Safety Limit Output (on = OK)	21	13	J1-16
16	Lower Safety Limit Output (on = OK)	23	12	J1-17
17	Drift Output (on = OK)	25	11	J1-18
18	Fault Output (on = OK)	27	10	J1-19
19	NC	29	9	J1-20
20	NC	31	8	J1-21
21	Program Enable (PE Input)	20	7	J1-22
22	Remote Enable (Input)	22	16	J1-23
23	Remote Start (Input)	24	NC	J1-24
24	Die Select 1 (LSB)	26	NC	J1-25
25	Die Select 2	28	NC	J2-10
26	Die Select 3	30	NC	J2-11
27	Die Select 4	32	NC	J2-12
28	Die Select 5 (MSB)	34	NC	J2-13
29	S4-2 Course Resolver	33	6	J2-24
30	S1-2 Course Resolver	35	5	J2-23
31	S2-2 Course Resolver	37	4	J2-22
32	S3-2 Course Resolver	36	3	J2-21

Fine Resolver Wiring

FINE RESOLVER WIRING				
CBUS Signal Number	Designation	Wire Color CBL-RL210-xxxx	Resolver Terminal #	MS Connector Pin
6	FS4	Black/White	6	F
3	FS3	Red	9	L
4	FS2	Black/Blue	8	K
5	FS1	Black/Red	7	H
1	R1	Black/Green	1	A
2	R2	Green	2	B
Note: To change direction of count, reverse S1 and S3 connections. Black/White indicates black wire with white stripes.				

Coarse Resolver Wiring

COARSE RESOLVER WIRING				
CBUS Signal Number	Designation	Wire Color CBL-RL210-xxxx	Resolver Terminal #	MS Connection Pin
7 and 32	CS3	Yellow	5	E
8 and 31	CS2	Black/White	4	D
9 and 30	CS1	Black/Yellow	3	C
	Shield		GND (Green Screw)	S
Note: To change direction of count, reverse S1 and S3 connections. Black/White indicates black wire with white stripes.				

37 Pin D-Sub Connector		37 Pin D-Sub Connector	
Pin #	Function	Connector Pin #	Function
1	VS-	20	Up Output
2	Down Output	21	Upper Safety Limit Output
3	Low Safety Limit	22	Drift Output
4	Fault Output	23	NC
5	NC	24	NC
6	NC	25	NC
7	NC	26	NC
8	NC	27	NC
9	NC	28	NC
10	NC	29	NC
11	NC	30	NC
12	NC	31	NC
13	Die ID 8	32	NC
14	Die ID 6	33	Die ID 7
15	Die ID 4	34	Die ID 5
16	Die ID 2	35	Die ID 3
17	Remote Start	36	Die ID 1
18	Program Enable (PE)	37	Remote Enable
19	VS+		

For Slot 2 of a MF2 Cradle, the I/Os will be allocated on the N19 card as shown in the table to the left.

7. Troubleshooting

Symptoms	Possible Causes
Unable to program unit parameters (Scale Factor, Offset, etc.)	1. Is the voltage level at the customer VS+/VS- input correct? 2. Is the machine moving? Programming of several parameters (i.e., Scale Factor) is disabled if the resolver is turning faster than 3 RPM.
Program memory is changing by itself.	Have proper grounding and shielding practices been applied?
Position and RPM readings are incorrect.	1. Is the resolver correctly wired? Follow the steps below for a quick check. a. turn power off to M7350 unit b. measure with following with an ohm meter: -- (R1 to R2) = 15 to 50 ohms -- (S1 to S3) = 50 to 150 ohms -- (S4 to S2) = 50 to 150 ohms
Broken wire bit in I/O status word.	1. Is the resolver cable properly grounded and shielded? Supply (VS+, VS-) less than 20 VDC? 2. Is resolver wiring correct? Follow instructions for ohming out resolver wiring above.
Mechanical Zero drifts.	1. Is the mechanical Resolver linkage loose? 2. Has the offset value been changed?
If all fails.	Call the local distributor or (630)668-3900 for service.

8. How to Order

Function Module

ASY-M7350-RSHC programmable resolver shut height controller
ASY-M7350-RSHI programmable resolver shut height indicator

Compatible Position Transducers

The M7350-RSHI requires a single-turn or single-turn geared series, such as Autotech's RL100, E1R, E7R, E8R or E9R series of resolvers. Please see appropriate Position Transducer Manual for complete ordering information on position transducers, cables, and appropriate accessories.

Cable (See appropriate Position Transducer Manual for ordering cable)

CBL-10T22-Cxxx 22AWG, 10 conductor (5 twisted pairs) overall foil shielded cable, without connector. "xxx" length must be ordered as 010, 020, 050 feet and increments of 50 feet (i.e. 100, 150, etc.) (2500 ft. max.)

CBL-10T22-Mxxx 22 AWG, 10 conductor (5 twisted pairs) overall foil shielded cable, with 10 pin MS connector (ECM-10REC-ITT) on one end. "xxx" length must be ordered as 010, 020, 050 feet and increments of 50 feet.

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