JAGUAR®

PLC and Analog Interface

Service Manual

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INTRODUCTION

This publication is provided solely as a guide for individuals who have received Technical Training in servicing the METTLER TOLEDO product.

Information regarding METTLER TOLEDO Technical Training may be obtained by writing, calling, or faxing to:

Mettler-Toledo, Inc.
1150 Dearborn Drive
Worthington, Ohio 43085-6712
ph: (614) 438-4400
fax: (614) 438-4444

FCC Notice

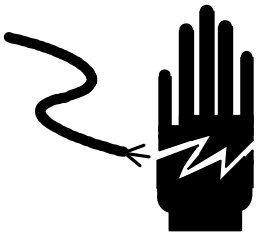
This device complies with Part 15 of the FCC Rules and the Radio Interference Requirements of the Canadian Department of Communications. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

METTLER TOLEDO RESERVES THE RIGHT TO MAKE REFINEMENTS OR CHANGES WITHOUT NOTICE.

PRECAUTIONS

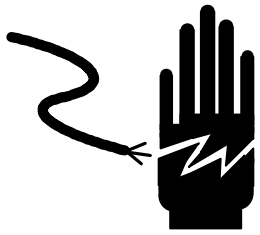
READ this manual BEFORE operating or servicing this equipment.



⚠ WARNING

ONLY PERMIT QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.

FOLLOW these instructions carefully.

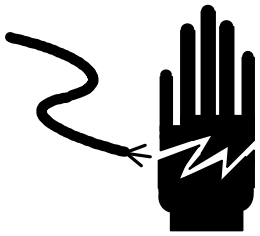


⚠ WARNING

FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD CONNECT TO PROPERLY GROUNDED OUTLET ONLY.

DO NOT REMOVE THE GROUND PRONG.

SAVE this manual for future reference.



⚠ WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment.

⚠ CAUTION

BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT ALWAYS REMOVE POWER AND WAIT AT LEAST THIRTY (30) SECONDS BEFORE ANY CONNECTIONS OR DISCONNECTIONS ARE MADE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT OR BODILY HARM.

ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance.

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

CALL METTLER TOLEDO for parts, information, and service.

CONTENTS

1 Allen-Bradley

Allen-Bradley RIO Network Specifications

This section describes the option that permits the Jaguar to communicate to Allen-Bradley Programmable Logic Controllers (PLCs) through direct connection to the A-B RIO network. The option consists of a Jaguar backplane-compatible I/O module and software that resides in the Jaguar, which implements the data exchange.

Refer to your Allen-Bradley documentation or Allen-Bradley directly for questions related to the A-B RIO network such as cable length, number of nodes, and PLC model compatibility. This manual does not attempt to provide all information pertaining to the Allen-Bradley RIO.

The Jaguar A-B RIO Option has the following features:

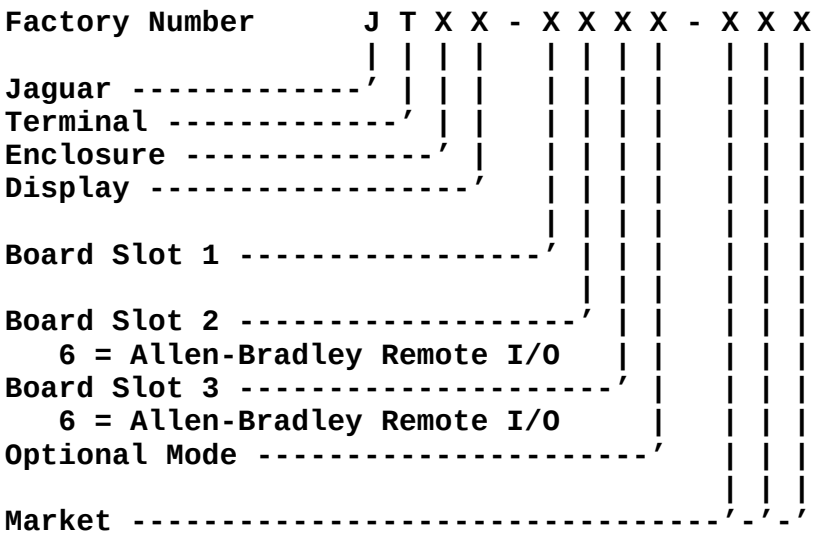
- A-B RIO Node Adapter Chip Set (licensed from Allen-Bradley) and termination for the A-B network cable (blue hose) on a three-position removable terminal block.
- User programmable RIO communication parameters are configured in software set up through the Jaguar keyboard/display. The parameters are as follows:

  57.6K, 115.2K, or 230.4K baud rate
  ¼, ½, ¾, full rack (depends upon the number of scales/interface)
  rack address
  starting quarter
  last rack designation

- Capability for bi-directional discrete mode communications of weight, display increments, status, and control data between the PLC and the Jaguar scale terminal.
- Capability for bi-directional block transfer communication of many Jaguar data variables. The option also allows the PLC to write messages to the Jaguar's lower display area.

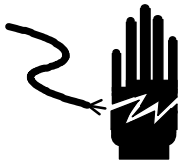
Factory Order Information

The Allen-Bradley Remote I/O PCB is available as a factory installed option or field installed kit. To order the AB Remote I/O PCB installed in the Jaguar from the factory, substitute a 6 in the Slot 2 or 3 order number. Only one PLC interface option may be installed in a Jaguar Chassis.



To order the Allen-Bradley Remote I/O as a field installed kit, use factory number 0917-0213.

AB RIO PCB Installation



⚠ WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

⚠ WARNING

DO NOT APPLY POWER TO THE JAGUAR UNTIL INSTALLATION OF COMPONENTS AND EXTERNAL WIRING HAVE BEEN COMPLETED.

To install the AB RIO PCB in the Jaguar:

- First disconnect power to the Jaguar by disconnecting the AC power cord from either the rear of the Jaguar, or at the AC outlet.
- Remove the Jaguar rear panel if installing in a GP (General Purpose) or HA (Hazardous area) unit.
- Set the Jumpers on the PCB (Refer to Jumper Settings Section).
- Insert the PCB in option slot 2 or 3 of the Jaguar.
- Tighten the two thumbscrews until the PCB is completely seated in the backplane connector.
- Connect the I/O wiring.
- Reinstall the rear panel on the GP/HA versions.
- Reconnect AC power.
- Enter Setup and configure the AB RIO options (Refer to the Jaguar Setup Section).

Communications

Information on data exchange to and from the Allen-Bradley RIO, and data formats are not made available by Allen-Bradley.

Jaguars on RIO
- Use Allen-Bradley licensed Technology.
- Looks like an A-B RIO Device.
- Use Standard *Blue Hose* connections.

The Allen-Bradley Remote I/O (RIO) network is an Allen-Bradley proprietary network that permits certain A-B PLCs to communicate to additional racks of input and output devices or to other peripheral devices that implement the RIO interface. The network has evolved with generations of A-B PLCs to implement higher speeds and more connections. The Jaguar utilizes component parts that are provided by A-B thereby assuring complete compatibility with the RIO network. Jaguars are recognized as an Allen-Bradley device by the PLC.

Each Jaguar connected to the RIO network represents a physical node. The connection is facilitated by a three-position removable terminal block on the Jaguar RIO Option back panel. The terminal block is labeled 1, SHLD, and 2. These terminals correspond to the terminals on the A-B PLC RIO connector. The wiring between the PLC and the Jaguar RIO connector uses the standard RIO cable supplied by Allen-Bradley. This cable is often referred to as the "blue hose." The cable installation procedures and specifications are the same as recommended by Allen-Bradley for the RIO network.

Node Address

If enabled, block transfer always uses the first quarter. The first scale is the second quarter, and the second scale is the third quarter.

Jaguar RIO Addressing
- Each scale is a quarter rack in discrete integer mode.
- Jaguars do quarter rack addressing.
- RIO configures through Jaguar setup.
- or 4 scales per RIO Option in discrete integer mode.
- Scales may be local or on ARCnet.
- Rack address must be contiguous.
- 2 scales with block transfer.
- 2 scales in floating point discrete mode.
- Jaguar uses a full-rack in floating point discrete mode, including the block transfer capability.

Although each Jaguar RIO Option represents one physical node, the addressing of the node is defined as a logical rack address. This address is determined by the system designer, then programmed into the Jaguar. Programming is done through the Allen-Bradley program block in setup. Each scale occupies a quarter rack in the RIO address space and the quarter may be defined as the first, second, third, or fourth quarter of a rack. It is also necessary to designate the location of the PLC which is the highest quarter used in a logical rack. Jaguar programming capabilities allow selection of the starting quarter and designation of the last rack.

The number of logical rack quarters may be more than one if the RIO Option is configured to interface with more than one scale. Since each scale represents one quarter and the RIO Option may be configured to interface with up to four scales, the Jaguar RIO Option may occupy up to four quarters. The quarters must be contiguous in a single logical rack, so the starting quarter must be low enough to accommodate all of the scales in a single logical rack. The Jaguar sets the number of quarters equal to the number of scales configured through the program block. The terminal only allows selection of a starting quarter that is possible.

In floating point mode, each scale uses one-half rack and the Jaguar always configures a full-rack.

Controlling Jaguar Discrete I/O using a PLC interface

Jaguar Terminal provides the ability to directly control its discrete outputs and read its discrete inputs via the (digital) PLC interface options. System integrators should be aware that Jaguar discrete I/O updates are synchronized with the Jaguar A/D rate, and not with the PLC I/O scan rate. This may cause a noticeable delay in reading inputs or in updating outputs as observed from the PLC to real world signals.

Data Definition

The A-B Remote I/O network supports three types of data exchange:

- **Discrete Data Transfer**—allows for bi-directional communication of discrete bit encoded information or 16 bit binary word (signed integer) numerical values.
- **Block Transfer**—provides bi-directional exchange of blocks of data. The PLC initiates data reads and data writes, and controls the data that is exchanged.
- **Floating Point Transfer**—allows bi-directional transfer of numeric data encoded in IEEE 754 single precision floating point format.

Discrete Data Integer or Division Discrete Read/Write Format

Each scale represents a quarter rack of data to the RIO Option and each quarter rack provides two input (read) and two output (write) words. A quarter logical rack has 32 input bits (two 16 bit words) and 32 output bits (two 16 bit words). The data in these input and output words is formatted as follows:

RIO Discrete Data to PLC
- Scale weight data.
- Setpoint status.
- Scale status.

DISCRETE READ - JAGUAR Output to PLC Input		
Bit Numbers	**Word 0**[1]	**Word 1**
0	Signed 16 Bit Integer Weight Data	Setpoint 1
1		Setpoint 2
2		Setpoint 3
3		Setpoint 4
4		Setpoint 5
5		Setpoint 6
6		Setpoint 7
7		Setpoint 8
8		ESC Key[2]
9		PAR 1.1[3]
10		PAR 1.2[3]
11		PAR 1.3[3]
12		Motion[4]
13		Net Mode[5]
14		Update in Progress[6]
15		Data OK[7]

1. Word 0 is a sixteen-bit signed integer that may represent the scale gross, net, tare, rate, setpoint #1, or displayed weight. Three bits, set by the PLC, designate data sent by the Jaguar.
2. Bit 8 is set to a 1 when the ESCAPE key is pressed on the keypad of the Jaguar where the RIO option is installed. The bit will be cleared to 0 when the display mode bits (see next table) change from 0 to a non-zero value.
3. Bits 9, 10, and 11 mirror the state of the first three input bits on the controller board of the Jaguar. These are labeled IN1, IN2, and IN3. If the input is ON (input grounded) then the bit is set to a 1.
4. Bit 12 is set to a 1 when the scale is unstable.
5. Bit 13 is set to a 1 when the scale is in the net mode.
6. When this flag is 1, the PLC scanner has read the data while the Jaguar is in the middle of updating the data. The PLC should ignore the data in this case and simply re-scan the data.
7. Bit 15 is set to a 1 when the scale is operating properly, not over or under capacity, and not in power up or expanded weight mode. The PLC program should continuously monitor this bit and the PLC processor “rack fault” bit (see A-B PLC documentation) to determine the validity of the discrete and block transfer data.

RIO Discrete Data from PLC
- Tare/Setpoint values.
- Mode Commands (CTPZ)
- Display Message Selection.

DISCRETE WRITE - PLC Output to JAGUAR Input		
Bit Numbers	**Word 0**	**Word 1**
0	Signed 16 Bit Integer Tare	Select 1[1]
1		Select 2[1]
2		Select 3[1]
3		Load Preset Tare[10]
4		Clear Command[2]
5		Tare Command[3]
6		Print Command[4]
7		Zero Command[5]
8		Disable Setpoint[6]
9		Display Mode[8]
10		Display Mode[8]
11		Display Mode[8]
12		PAR 2.1[9]
13		PAR 2.2[9]
14		PAR 2.3[9]
15		Load SP-1 Value[7]

1. A binary value in bits 0-2 select the data in Discrete Read WORD 0. 0 = gross weight, 1 = net weight, 2 = displayed weight, 3 = tare weight, 4 = setpoint 1, 5 = Rate. Values greater than five are gross weight.
2. A transition from 0 to 1 causes a “clear” (return to gross) command.
3. A transition from 0 to 1 causes a “tare” command.
4. A transition from 0 to 1 causes a “print” command.
5. A transition from 0 to 1 causes a “zero” command.
6. Set Bit 8 to 0 to disable the setpoint outputs. Set Bit 8 to 1 to enable the setpoint outputs.
7. A transition from 0 to 1 loads the value in WORD 0 into setpoint 1 value in Jaguar.
8. Bits 9, 10, and 11 determine how the data is displayed in the lower display area. 0 = normal display mode, 1 = display literal 1, 2 = display literal 2, 3 = display literal 3, 4 = display literal 4, 5 = display literal 5, 6 = reserved, 7 = display from block transfer input. Pressing ESCAPE also clears the display to normal mode. Display literals may be pre-programmed in Jaguar setup through the Configure Memory program block. Literals may also be sent to Jaguar from the PLC (lit01, lit02, lit03, lit04, or lit05).
9. Bits 12, 13, and 14 control the state of the first three output bits on the controller board of the Jaguar. These are labeled OUT1, OUT2, and OUT3. A 1 causes the output to be turned ON.
10. A transition from 0 to 1 loads the value in WORD 0 into the preset tare register.

Extended Weight Discrete Read Format

The Jaguar operating system has been extended to optionally provide 21-bits of weight information for Discrete Read by the Allen-Bradley PLC. The extended data format is applicable to both rate and weight information.

The Jaguar operator selects the Extended-Weight Discrete Read format through the following menu selections:

Config Options
Allen-Bradley
Scale Setup
Data Format? Ext

The lower 16 bits of the weight are in Word 0 of the Discrete Read data as before. The upper 5 bits of the weight information are now in bits 0 to 4 of Word 1 of the Discrete Read data.

The setpoint coincidence flags for setpoints 1, 2, and 3 are now in bits 5, 6, and 7 of Word 1 of the Discrete Read data. Setpoints 4 through 8 have been eliminated in the Extended-Weight Discrete Read data to make room for the extended weight information.

Bit 14 of the Word 1 of the Discrete Read data is an “update-in-progress” flag. When this flag is 1, the Allen-Bradley PLC scanner has read the data while the Jaguar is in the middle of updating the data. The PLC should ignore the data in this case and simply re-scan the data.

Each scale represents a quarter rack of data to the RIO Option. A quarter logical rack has 32 input bits (two 16 bit words) and 32 output bits (two 16 bit words). The data in these input and output words is formatted as follows:

Extended Weight Discrete Read Output to PLC Input		
Bit Numbers	**Word 0[1]**	**Word 1**
0	Lower 16 Bits Integer Weight Data (Upper 5 bits of weight are bits 0-4 of word 1.)	Weight 17
1		Weight 18
2		Weight 19
3		Weight 20
4		Weight 21 (sign bit)
5		Setpoint 1
6		Setpoint 2
7		Setpoint 3
8		ESC Key[2]
9		PAR 1.1[3]
10		PAR 1.2[3]
11		PAR 1.3[3]
12		Motion[4]
13		Net Mode[5]
14		Update In Progress[6]
15		Data OK[7]

1. Word 0 and 1 is a 21-bit signed integer that may represent the scale gross, net, tare, rate, setpoint #1, or displayed weight. Three bits, set by the PLC, designate data sent by the Jaguar.
2. Bit 8 is set to a 1 when the ESCAPE key is pressed on the keypad of the Jaguar where the RIO option is installed. The bit will be cleared to 0 when the display mode bits (see next table) change from 0 to a non-zero value.
3. Bits 9, 10, and 11 mirror the state of the first three input bits on the controller board of the Jaguar. These are labeled IN1, IN2, and IN3. If the input is ON (input grounded) then the bit is set to a 1.
4. Bit 12 is set to a 1 when the scale is unstable.
5. Bit 13 is set to a 1 when the scale is in the net mode.
6. When this flag is 1, the PLC scanner has read the data while the Jaguar is in the middle of updating the data. The PLC should ignore the data in this case and simply re-scan the data.
7. Bit 15 is set to a 1 when the scale is operating properly, not over or under capacity, and not in power up or expanded weight mode. The PLC program should continuously monitor this bit and the PLC processor “rack fault” bit (see A-B PLC documentation) to determine the validity of the discrete and block transfer data.

Floating Point Data Format and Compatibility

In the Floating Point Message mode, the PLC and Jaguar exchange weight, rate, setpoint, and tare data in single-precision floating point format. The IEEE Standard for Binary Floating-Point Arithmetic, ANSI/IEEE Standard 754-1985, specifies the format for single-precision floating point numbers. It is a 32-bit number that has a one-bit sign, an eight-bit exponent, and a 23-bit mantissa. The 8-bit exponent provides scaling of the weight and rate data. The 23-bit mantissa allows representation of 8 million unique counts.

Although the single-precision floating point number provides greater numerical precision and flexibility than the integer weight representations, it has some limitations. The representation of the weight may not be exact. This is particularly true for the extended-resolution weight fields for high-precision bases.

Some Allen-Bradley PLC's require special "integrity checking" in order to communicate floating point numbers across the Remote I/O link. The Allen-Bradley PLC-5 and KTX Scanner Card programs must check two data integrity bits to verify the integrity of the floating point data the data it reads from the Jaguar. Allen-Bradley SLC programs always read valid floating point data from the Jaguars and do not have to make special checks to guarantee the validity of the floating point data. The Allen-Bradley PLC-3 and PLC-5/250 cannot support Jaguars in floating point mode because they cannot guarantee the integrity of the floating point data.

Floating Point Transfer

The Jaguar can communicate weight to the PLC in a floating point weight format with integer commands. The Jaguar must set up in the "floating point" weight mode.

The PLC issues a command for a particular scale by setting a Scale Command in the PLC Output Message. Each Command is a two-byte integer, and there is a separate Command for each scale. The Jaguar recognizes a new command from the PLC when it sees a new value in the Scale Command register. If the Command has an associated floating point value, the PLC must set the value in the floating point output register before issuing the Command.

The Jaguar acknowledges each non-Null command from the PLC. After processing a command for a particular scale, the Jaguar sets a new value in the Command Acknowledge bits for the scale in the PLC Input Message. The PLC must wait for the command acknowledgment before issuing a new command.

The PLC can select a rotation of up to nine floating point, real-time input fields from each scale. Real-time fields are the weight and rate fields. For example, the PLC can alternatively look at weight and rate by issuing commands to place both in the rotation. The Jaguar stores the rotation in Shared Data so that the rotation does not have to be reinitialized after each power cycle. When the PLC does not set up an input rotation, the default input rotation consists of gross weight only

The PLC may request that the Jaguar continually cycle among the fields of the input rotation by setting command 0. Then the Jaguar will automatically select the next field from the input rotation at the next A-to-D update. For example, the A-to-D update rate for an Analog Scale is 17 hertz when the Application Type is set to Process Application. Then, the PLC application must be ready to process the next input field in 58 milliseconds.

To control the pace of the input rotation, PLC may request the next field from the input rotation by alternating between commands 1 and 2. The PLC needs to change the command value so that the Jaguar knows when the PLC is requesting a new field. Then, the PLC controls when the Jaguar switches to the next field of input rotation.

Commands 10 through 29 are “Report Data” commands. As long as one of the Report Data commands is in the Scale Command, the Jaguar will report the requested data and will not report data from the input rotation.

When the PLC requests a real-time field from the Jaguar, the Jaguar acknowledges the command only once but sends a new value for that field at every analog-to-digital weight update. The PLC requests real-time fields either through the report data command or through the input rotation.

When the PLC requests a static field from the Jaguar, the Jaguar acknowledges the command once and sets a new value for that field in the output register once. However, that value remains in the output register until the PLC issues another command. Examples of static fields are setpoint and filter values.

After acknowledging the previous command, the Jaguar will act on a new command only when the PLC sets a new value in a Scale Command in the PLC Output message.

In the “weight-synchronous” communications mode, the Jaguar initiates a communication exchange with the PLC at every A-to-D weight update. This mode is also known as the Discrete I/O mode in Allen-Bradley terminology. The weight-synchronous communications is a high-speed, real-time message interface between the Jaguar and PLC for process control.

The PLC can exchange data with the JagBASIC application in support of customer-specific requirements. The PLC and JagBASIC application define the meaning of the data. Floating point fields in the JagBASIC custom messages may be in any format and have any value as long as the PLC and JagBASIC application use them accordingly.

PLC Output Message Format

Two data "slots" are available for Allen-Bradley Remote I/O. Typically, the user assigns one data slot per scale in the Jaguar "Config Options" menu. However, the user can increase the bandwidth of the I/O channel for one scale by selecting only one scale in the "Config Options" menu. The Jaguar uses the following criteria for assigning scale slots to scales:

- If the user selects only one scale in the "Config Options" menu, then the Jaguar assigns slots 1 and 2 for communicating the scale data with the PLC.
- If the user selects two scales in an Allen-Bradley configuration, then the Jaguar assigns one scale per scale slot.

Byte 0-1	Reserved
Byte 2-3	Scale Slot 1 Command
Byte 4-7	Scale Slot 1 Single-Precision Floating Point Value
Byte 8-9	Scale Slot 2 Command
Byte 10-13	Scale Slot 2 Single-Precision Floating Point Value

PLC Output Scale Commands

Dec	Hex	Command
0	00	Report next field from input rotation at next A/D update [7]
1	01	Report next field from input rotation [6, 7]
2	02	Report next field from input rotation [6, 7]
3	03	Reset Input Rotation
10	0a	Report Gross Weight [2, 7]
11	0b	Report Net Weight [2, 7]
12	0c	Report Tare Weight [2, 7]
13	0d	Report Fine Gross Weight [2, 7]
14	0e	Report Fine Net Weight [2, 7]
15	0f	Report Fine Tare Weight [2, 7]
16	10	Report Rate [2, 7]
17	11	Report JagBASIC Custom Input 1 to PLC [2, 7]
18	12	Report JagBASIC Custom Input 2 to PLC [2, 7]
19	13	Report Low-Pass Filter Corner Frequency [2]
20	14	Report Notch Filter Frequency [2]
21	15	Report Setpoint 1 Coincidence Value [2, 4]
22	16	Report Setpoint 2 Coincidence Value [2, 4]
23	17	Report Setpoint 1 Dribble Value [2, 4]
24	18	Report Setpoint 2 Dribble Value [2, 4]
25	19	Report Setpoint 1 Tolerance Value [2, 4]
27	1b	Report JagBASIC Custom Input 3 to PLC [2]
28	1c	Report JagBASIC Custom Input 4 to PLC [2]
29	1d	Report Error After Error Indication [2]
30	1e	Report Primary Units - Low Increment Size [2]
40	28	Add Gross Weight to Input Rotation
41	29	Add Net Weight to Input Rotation
42	2a	Add Tare Weight to Input Rotation
43	2b	Add Fine Gross Weight to Input Rotation
44	2c	Add Fine Net Weight to Input Rotation
45	2d	Add Fine Tare Weight to Input Rotation
46	2e	Add Rate to Input Rotation
47	2f	Add JagBASIC Custom Input 1 to PLC to Input Rotation
48	30	Add JagBASIC Custom Input 2 to PLC to Input Rotation

60	3c	Set Programmable Tare [3]
61	3d	Set Push Button Tare
62	3e	Clear Command
63	3f	Print Command
64	40	Zero Command
65	41	Select Scale A
66	42	Select Scale B
67	43	Select Other Scale
68	44	Custom Print 1 Command
69	45	Custom Print 2 Command
70	46	Custom Print 3 Command
71	47	Custom Print 4 Command
72	48	Custom Print 5 Command
73	49	Set Low-Pass Filter Corner Frequency [3]
74	4a	Set Notch Filter Frequency [3]
75	4b	Reset Escape Key
78	4e	Disable Error Display
79	4f	Enable Error Display
80	50	Set Normal Display Mode
81	51	Display Literal 1
82	52	Display Literal 2
83	53	Display Literal 3
84	54	Display Literal 4
85	55	Display Literal 5
87	57	Display Literal in Shared Data Block of Message
88	58	Disable Numeric Display
89	59	Enable Numeric Display
90	5a	Set Discrete Output 1 = ON
91	5b	Set Discrete Output 2 = ON
92	5c	Set Discrete Output 3 = ON
93	5d	Set Discrete Output 4 = ON
100	64	Set Discrete Output 1 = OFF
101	65	Set Discrete Output 2 = OFF
102	66	Set Discrete Output 3 = OFF
103	67	Set Discrete Output 4 = OFF
110	6e	Set Setpoint 1 Coincidence Value [3, 4]
111	6f	Set Setpoint 1 Dribble Value [3, 4]
112	70	Set Setpoint 1 Tolerance Value [3, 4]
114	72	Setpoint 1 = Enabled [4]
115	73	Setpoint 1 = Disabled [4]
116	74	Setpoint 1 = Gross Weight [4]
117	75	Setpoint 1 = Net Weight [4]
118	76	Setpoint 1 = Rate [4]
119	77	Setpoint 1 = Filling [4]
120	78	Setpoint 1 = Discharging [4]
121	79	Setpoint 1 = Latching Enabled [4]
122	7a	Setpoint 1 = Latching Disabled [4]
123	7b	Setpoint 1 = Reset Latch [4]
130	82	Set Setpoint 2 Coincidence Value [3, 4]
131	83	Set Setpoint 2 Dribble Value [3, 4]
134	86	Setpoint 2 = Enabled [4]
135	87	Setpoint 2 = Disabled [4]
136	88	Setpoint 2 = Gross Weight [4]
137	89	Setpoint 2 = Net Weight [4]
138	8a	Setpoint 2 = Rate [4]

139	8b	Setpoint 2 = Filling [4]
140	8c	Setpoint 2 = Discharging [4]
141	8d	Setpoint 2 = Latching Enabled [4]
142	8e	Setpoint 2 = Latching Disabled [4]
143	8f	Setpoint 2 = Reset Latch [4]
150	96	Set JagBASIC Custom Output 1 From PLC [5]
151	97	Set JagBASIC Custom Output 2 From PLC [5]
152	98	Set JagBASIC Custom Output 3 From PLC [5]
153	99	Set JagBASIC Custom Output 4 From PLC [5]
160	a0	Apply Scale Setup
161	a1	Write Scale Calibration to EEPROM
162	a2	Disable Tare from Control Panel
163	a3	Enable Tare from Control Panel

Notes:

2. A command requiring the Jaguar to report a specific value in the PLC input message. As long as one of these commands is in the Scale Command, the Jaguar will respond with the requested data and not with data from the input rotation.
3. A command requiring a floating point value output from the PLC to the Jaguar. The Jaguar reflects back the floating point value in the floating point register of input message to the PLC.
4. Indicates that the setpoint numbers are relative to each scale in the Jaguar. Scale A uses Setpoints 1 and 2. Scale B uses Setpoints 3 and 4.
5. A command in which a JagBASIC Application and the PLC define the format of the data which has a length of four bytes.
6. A command used by the PLC to select the next field from the input rotation. The PLC must alternate between these two commands to tell the Jaguar when to switch to the next field of the input rotation.
7. A command that requests real-time fields from the Jaguar. The Jaguar updates the input register to the PLC at the A/D update rate of scale.

PLC Output Message Shared Data Command

The PLC Output Message Shared Data Command is not available in Allen-Bradley PLCs. Allen-Bradley PLCs access Shared Data using Block Transfer mode.

PLC Input Message Format

The Allen-Bradley Remote I/O has two slots available.

Byte 0-1	Scale Slot 1 Command Response
Byte 2-5	Scale Slot 1 Single-Precision Floating Point Value
Byte 6-7	Scale Slot 1 Status
Byte 8-9	Scale Slot 2 Command Response
Byte 10-13	Scale Slot 2 Single-Precision Floating Point Value
Byte 14-15	Scale Slot 2 Status

Scale Input Status Format

The Jaguar sets the following status's in response to scale commands.

Command	Response
Bits 0-7	Reserved
Bit 8	Floating Point Input Indicator
Bit 9	Floating Point Input Indicator
Bit 10	Floating Point Input Indicator
Bit 11	Floating Point Input Indicator
Bit 12	Floating Point Input Indicator
Bit 13	Data Integrity Bit 1 [8]
Bit 14	Command Acknowledge 1
Bit 15	Command Acknowledge 2

Scale Status

Bit 0	Setpoint 1 Feeding
Bit 1	Setpoint 2 Feeding
Bit 2	Setpoint 1 Fast Feeding
Bit 3	Setpoint 2 Fast Feeding
Bit 4	Setpoint 1 In Tolerance
Bit 5	Scale Selected (weight on local Jaguar display)
Bit 6	JagBASIC Custom Bit 1
Bit 7	JagBASIC Custom Bit 2
Bit 8	Escape Keystroke
Bit 9	Discrete Input 1
Bit 10	Discrete Input 2
Bit 11	Discrete Input 3
Bit 12	Motion
Bit 13	Net
Bit 14	Data Integrity Bit 2 [8]
Bit 15	Data OK/Error Indication

Note:

8. Data Integrity Bits required for Allen-Bradley PLC-5 Remote I/O Scanner. Both bits must have the same polarity for the data to be valid.

After processing a PLC Command, the Jaguar acknowledges it by setting a new value in the two Command Acknowledge bits. The Jaguar rotates sequentially among values 1, 2, 3, 1, 2, 3, 1, 2, ... to acknowledge that it has recognized and processed a new, non-Null Command. When the PLC sees a new, non-zero value in the Command Acknowledge bits, it must verify the value is in sequence to confirm that the Jaguar has successfully completed the last command. The default value for the Command Acknowledge bits is 0.

The Floating Point Input Indicator bits tell the PLC what value is currently in Scale Single-Precision Floating Point Value. The PLC can set up a rotation of up to nine different fields by sending output commands to the Jaguar. Values 0, 1, 2, 3, 4, 5, 6, 7, and 8 represent floating point fields that may be part of the input rotation. The PLC can also issue a command to request that the Jaguar report a specific value. The Floating Point Input Indicator bits can have the following values:

0	Gross Weight [9]
1	Net Weight [9]
2	Tare Weight [9]
3	Fine Gross Weight [9]
4	Fine Net Weight [9]
5	Fine Tare Weight [9]
6	Rate [9]
7	JagBASIC Custom Variable 1 [9]
8	JagBASIC Custom Variable 2 [9]
9	JagBASIC Custom Variable 3
10	JagBASIC Custom Variable 4
11	Low-Pass Filter Corner Frequency
12	Notch Filter Frequency
13	Setpoint 1 Coincidence
14	Setpoint 2 Coincidence
15	Setpoint 1 Dribble
16	Setpoint 2 Dribble
17	Setpoint 1 Tolerance
18	Primary Units-Low Increment Size
19-28	Reserved
29	Last Jaguar Error Code
30	No Data Response - Command Successful
31	No Data Response - Command Failed

Note:

9. Indicates real-time fields that the PLC may request either through the input rotation or through “report” commands. The PLC may request the other fields only from the “report” commands.

There are two custom status bits that a JagBASIC application can use to communicate special status’s to the PLC. Use them wisely. The JagBASIC application and PLC define the meaning of these bits.

The Data OK/Error indication bit reports scale over capacity, scale under zero, scale communication, and cluster communication off-line error conditions. When the PLC sees an error indication, it can send a command to the Jaguar to get the latest error status.

There are two Data Integrity Bits that the Jaguar uses to maintain data integrity when communicating with the Allen-Bradley PLC-5 Remote I/O Scanner or KTX Scanner Card. One bit is in the beginning byte of the data and the second bit is in the ending byte of the data for a scale slot. The PLC program must verify that both data integrity bits have the same polarity for the data in the scale slot to be valid. There is a remote possibility that the PLC program will see several consecutive invalid reads when the Jaguar is freely sending weight

updates to the PLC-5. When the PLC-5 program detects this condition, it should send a new command to the Jaguar.

The Allen-Bradley SLC PLC programs do not have to make special checks to guarantee the validity of the floating point data.

Shared Data Mode

The Shared Data mode PLC communications is not available in Allen-Bradley PLCs. Block Transfer communications is used instead.

Block Transfer

Don't Use Block Transfer Mode for Real Time Communications.

Block Transfer mode is much less efficient than the weight-synchronous modes, which are optimized for real time communications of weight and status data. Block Transfer mode accesses the Jaguar “Shared Data” directory structure each time a data item is accessed. By contrast, the weight-synchronous mode communications has a direct interface to a limited number of real time Jaguar data fields.

Block Transfer Data

Block transfer allows the Jaguar and PLC to exchange many types of data in blocks of up to 128 bytes. Block transfer also enables the PLC to write messages directly to the Jaguar's lower display area.

Block transfer works concurrently with discrete data. Discrete mode communicates continuously in the background and a block transfer occurs only when the PLC program executes a block transfer read or write instruction. Data transfer is controlled by the PLC.

Block transfer data is formatted as follows:

BLOCK TRANSFER WRITE - PLC to JAGUAR	
Byte Number	**Description**
0 - 1	1 Word Display Mode [1]
2 - 17	16 Byte Display String [2]
18 - 25	8 Byte Floating Point Write Field Code [3]
26 - 29	Floating Point Write Value [4]
30 - 37	8 Byte String Write Field Code [5]
38 - 77	40 Byte Data String [6]
78 - 85	8 Byte Floating Point Read Field Code [7]
86 - 93	8 Byte String Read Field Code [8]
94 - 127	Reserved

Block transfer writes (BTW) and block transfer reads (BTR) are an ordered pair. A BTR must be preceded by a BTW.

1. The integer value of this word determines how the Jaguar display operates. The word defines display mode of data in the next field. For this byte to have significance, the discrete Display Mode bits must be set to 7. 0 = reset display to normal mode, 1 = display until over-written by the PLC or until ESC pressed, 2 = display for 30 seconds, 3 = display for 60 seconds, any value greater than 3 = reserved. The number must be a 16 bit integer (not ASCII).
2. Bytes 2 through 17 are a sixteen-byte string of displayable ASCII characters that can be transferred from the PLC to the Jaguar. The string is not displayed unless the discrete display mode bits are set to 7 and the preceding word is set to non-zero for the display mode.
3. Bytes 18 through 25 are an eight-byte ASCII Jaguar field code that identifies where the floating point numeric value in the next field will be loaded. The field code is five right-justified bytes expanded to eight with three leading spaces. The Floating Point Data Fields table below lists the available fields.
4. Bytes 26 through 29 comprise a floating point number. This floating point format is also used in the A-B PLC. The value of these bytes will be loaded into the Jaguar field identified by bytes 18 through 25 (see note 3 above).
5. Bytes 30 through 37 are an eight-byte ASCII Jaguar field code that identifies where the ASCII string in the next field will be loaded. The field code is five right-justified bytes expanded to eight with three leading spaces. The String Data Fields table below lists the available fields.
6. The string in this field will be loaded into the Jaguar field identified by bytes 30 through 37. If the string is shorter than 40 bytes it must be left-justified and null-terminated.
7. Bytes 78 through 85 are an eight-byte ASCII Jaguar field code requesting the value that will be sent in the floating point value field for a Block Transfer read from the Jaguar to the PLC. The field code is five right-justified bytes expanded to eight with three leading spaces. The Floating Point Data Fields table below lists the available fields.
8. Bytes 86-93 are an eight-byte ASCII Jaguar field code requesting the string that will be sent in the string field for a Block Transfer read from the Jaguar to the PLC. The field code is five right-justified bytes expanded to eight with three leading spaces. The String Data Fields table below lists the available fields.

RIO Block Transfer to PLC
- Weight and other FP values.
- ASCII string fields.
- Operator response fields.

BLOCK TRANSFER READ - JAGUAR to PLC	
Byte Number	**Description**
0 - 7	8 byte Floating Point Read Field Code[1]
8 - 11	Floating Point Read Value[2]
12 - 19	8 Byte String Read Field Code[3]
20 - 59	40 Byte Data String[4]
60 - 127	Reserved

1. Bytes 0 through 7 are an eight-byte ASCII Jaguar field code representing the floating point value that will be sent in the next field. The field code is five right-justified bytes expanded to eight with three leading spaces. The floating point read field code is used by the PLC to verify that data in the floating point read value field is correct.
2. Bytes 8 through 11 comprise a floating point number. This floating point format is also used in the A-B PLC. The value of these bytes will be loaded into the Jaguar field identified by bytes 0 through 7 (see note 1 above).
3. Bytes 12 through 19 are an eight-byte ASCII Jaguar field code requesting the string that will be sent in the next field. The field code is five right-justified bytes expanded to eight with three leading spaces. The string read field code is used by the PLC to verify that information in the data string field is correct.
4. Bytes 20 through 59 are the Jaguar field by the string read field code. If the string is shorter than 40 bytes it will be left-justified.

Floating Point and String Data Field Codes

The following charts describe the floating point and string data fields that the Jaguar can access. String data fields are serial ASCII character strings. Each table contains the following information:

Field Code—is the ASCII field that must be loaded into the Block Transfer write buffer. It identifies the data that is written to the Jaguar or returned by the Jaguar in a Block Transfer read.

The field code must be expanded to eight bytes by filling with three leading spaces. If the field code contains an "***n***" it should be replaced by the scale number (1 or 2 for scale A or B) or the setpoint number (1-8).

Description—is a description of the field.

Read/Write—indicates whether the PLC can read and/or write to the field.

Length—is the number of bytes (length) of the field. All floating point values are 4 bytes (2 words) long. Strings are the length specified.

Floating Point Data Fields			
Field Code	**Description**	**Read/ Write**	**Length**
wtn10	Gross Weight	R	4
wtn11	Net Weight	R	4
wtn12	Auxiliary Gross Weight	R	4
wtn13	Auxiliary Net Weight	R	4
wsn04	Tare Weight	R	4
wsn05	Auxiliary Tare Weight	R	4
spn05	Setpoint Coincidence Value	R/W	4

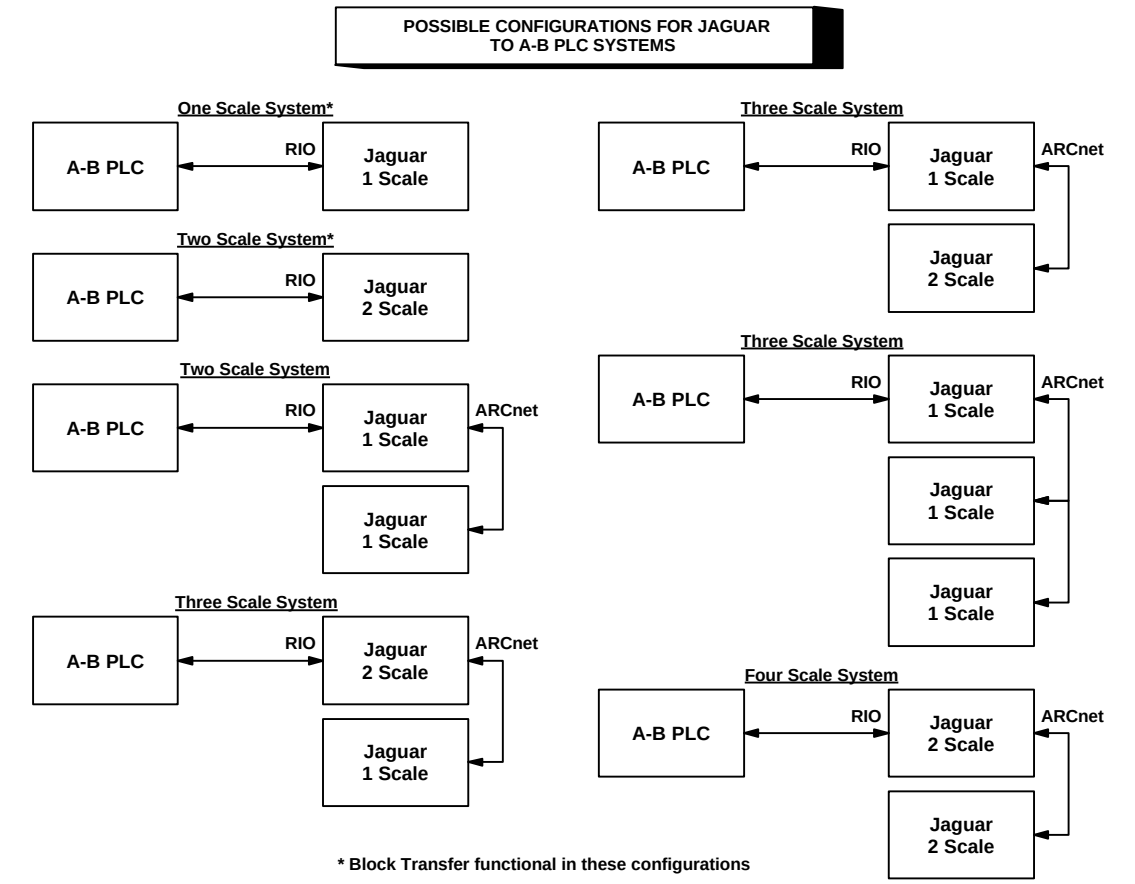
String Data Fields			
Field Code	**Description**	**Read/ Write**	**Length**
wtn01	Gross Weight	R	12
wtn02	Net Weight	R	12
wtn03	Weight Units	R	2
wtn04	Auxiliary Gross Weight	R	12
wtn05	Auxiliary Net Weight	R	12
wtn06	Auxiliary Weight Units	R	2
s_200	Scale Motion A (0 or 1 binary)	R	1B[1]
s_201	Center of Zero A (0 or 1 binary)	R	1B[1]
s_202	Over Capacity A (0 or 1 binary)	R	1B[1]
s_203	Under Zero A (0 or 1 binary)	R	1B[1]
s_204	Net Mode A	R	1B[1]
s_207	Scale A Selected	R	1B[1]
s_208	Scale Motion B	R	1B[1]
s_209	Center of Zero B	R	1B[1]
s_20a	Over Capacity B	R	1B[1]
s_20b	Under Zero B	R	1B[1]
s_20c	Net Mode B	R	1B[1]
s_20f	Scale B Selected	R	1B[1]
wsn01	Scale Mode (Gross or Net)	R	1
wsn02	Tare Weight	R	12
wsn03	Auxiliary Tare Weight	R	12
wsn06	Current Units (1=primary, 2=secondary)	R	1I[3]
wsn07	Tare Source (1=PB, 2=KB, 3=auto)	R	1I[3]

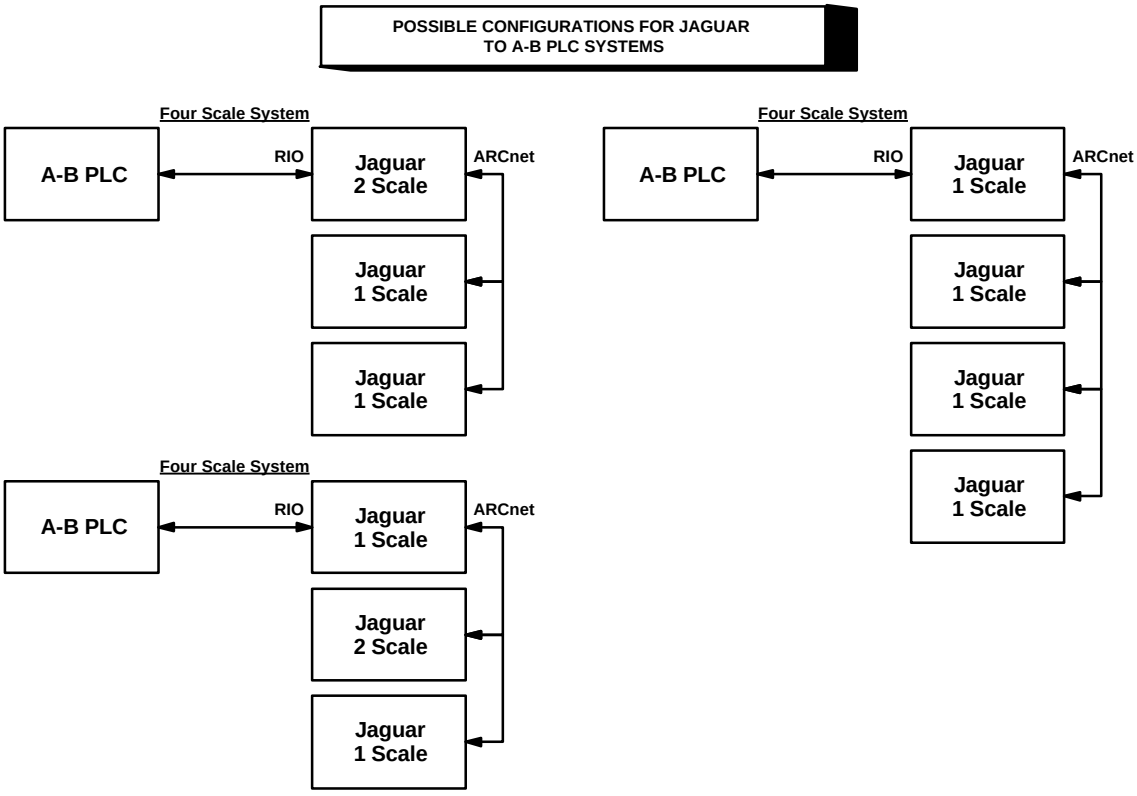
String Data Fields			
Field Code	**Description**	**Read/ Write**	**Length**
csn01	Auxiliary Display Units (1=lb, 2=kg, 3=g, 4=oz, 5=lb/oz, 6=troy oz, 7=pennyweight, 8=metric tons, 9=tons, 10=custom)	R	1I[3]
csn02	Custom Units Name	R/W	6
csn18	Scale ID	R/W	8
spn01	Setpoint Name	R/W	8
spn02	Setpoint Assignment (0=none, 1=scale A, 2=scale B)	R	1I[3]
jag07	Julian Date	R	8
jag08	Julian Time	R	8
jag09	Consecutive Number	R/W	2
jag11	Software ID	R	12
jag20	Time	R	11
jag21	Weekday	R	10
lit01[2]	User Literal 1	R/W	40
lit20	User Literal 20	R/W	40
Pmt01[2]	User Prompt 1	R/W	40
Pmt20	User Prompt 20	R/W	40
var01[2]	User Variable 1	R/W	40
var20	User Variable 20	R/W	40

1. Fields identified as 1B are returned as a binary 0 or 1 designating false or true.
2. There are 20 each user literals, prompts and variables numbered 01-20.
3. Fields identified as 1I are returned as integer values as described.

Remote Scale Sharing

Jaguar's remote scale sharing feature makes it possible for up to four networked scales to share one A-B RIO interface when communicating in integer data mode, or up to two networked scales when communicating in floating point data mode. The first scale must be in the same terminal as the RIO option; the second scale can be either local or remote; the third and fourth must be remote. The charts below show all possible configurations for up to four scales interfaced to an Allen-Bradley PLC through a single Jaguar A-B RIO option.


POSSIBLE CONFIGURATIONS FOR JAGUAR
TO A-B PLC SYSTEMS
One Scale System*
A-B PLC
RIO
Jaguar
1 Scale
Two Scale System*
A-B PLC
RIO
Jaguar
2 Scale
Two Scale System
A-B PLC
RIO
Jaguar
1 Scale
ARCnet
Jaguar
1 Scale
Three Scale System
A-B PLC
RIO
Jaguar
2 Scale
ARCnet
Jaguar
1 Scale
Three Scale System
A-B PLC
RIO
Jaguar
1 Scale
ARCnet
Jaguar
2 Scale
Three Scale System
A-B PLC
RIO
Jaguar
1 Scale
ARCnet
Jaguar
1 Scale
Jaguar
1 Scale
Four Scale System
A-B PLC
RIO
Jaguar
2 Scale
ARCnet
Jaguar
2 Scale
* Block Transfer functional in these configurations


POSSIBLE CONFIGURATIONS FOR JAGUAR
TO A-B PLC SYSTEMS
Four Scale System
A-B PLC
RIO
Jaguar
2 Scale
ARCnet
Jaguar
1 Scale
Jaguar
1 Scale
Four Scale System
A-B PLC
RIO
Jaguar
1 Scale
ARCnet
Jaguar
1 Scale
Jaguar
1 Scale
Jaguar
1 Scale
Four Scale System
A-B PLC
RIO
Jaguar
1 Scale
ARCnet
Jaguar
2 Scale
Jaguar
1 Scale
Four Scale System
A-B PLC
RIO
Jaguar
1 Scale
ARCnet
Jaguar
2 Scale
Jaguar
1 Scale

Allen-Bradley Jumper Settings

The Allen-Bradley PCB has three jumpers. W2 and W3 must be installed. W1 must be installed in the “I3” position.

Status Lights

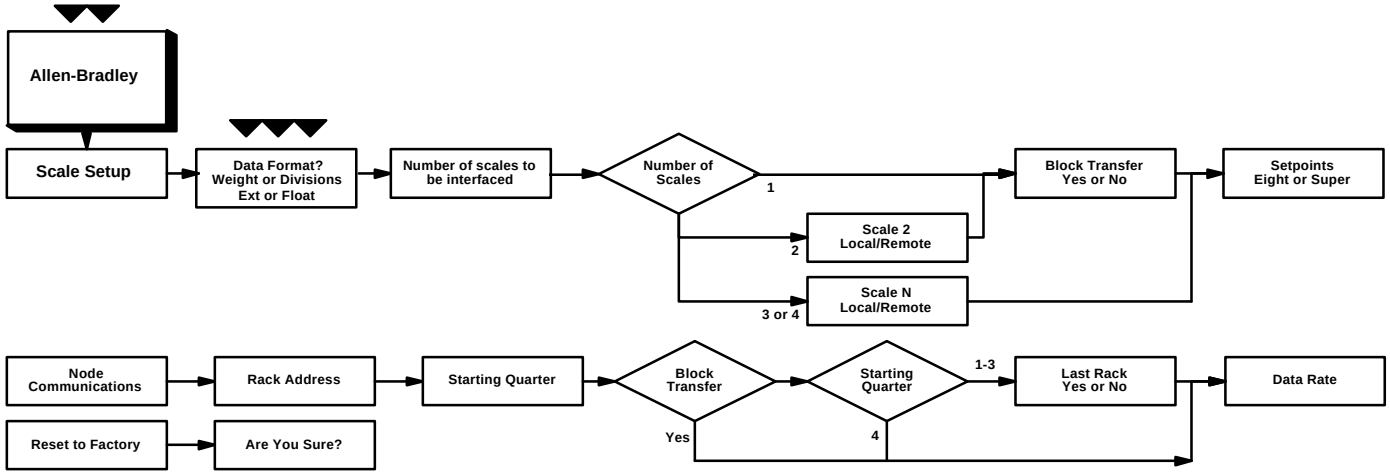
The Allen-Bradley option board has a status LED with three modes:

- ON—indicates normal operation
- Flashing—indicates the PLC is in Program Mode
- OFF—indicates a communication problem with the PLC

Allen-Bradley Setup In Jaguar

The Jaguar automatically detects the presence of an Allen-Bradley RIO option board if one is installed. When detected, the terminal adds the Allen-Bradley parameters in a program block immediately following the Diagnostics block called ***Config Options***. You can configure these parameters just as you configured the other blocks.

To configure the Allen-Bradley, first select ***Config Options***, then select the ***Allen-Bradley*** block. The following diagram describes the Allen-Bradley program block:



Scale Setup Sub-block

You must enter setup and configure each scale that is interfaced with the A-B RIO network. Refer to Chapter 3 of the Jaguar Service Manual for complete details on configuring the Network Program Block.

The divisions display option is useful for heavy capacity scales that exceed the ± 32767 range of a signed integer in displayed weight units.

Local refers to a scale in the same terminal as the A-B option. Remote refers to a scale interfaced across ARCnet.

The Scale Setup block lets you specify how the Allen-Bradley interface is used. Several options are available to correspond with your system setup.

To configure the block:

1. Press ENTER at the **Allen-Bradley** prompt to access the program block.
2. Press ENTER at the **Scale Setup** prompt. At the **Data Format?** prompt, press SELECT to choose the desired weight display option:
   - Wgt—displays scale weight in the selected weight unit (lb, kg, or g).
   - Div—displays scale weight in display divisions. The PLC multiplies the display divisions by the increment size to calculate the weight in display units.
   - Ext—displays scale weight in the extended 21 signed bit format.
   - Flt---displays weight in floating point data format

Please refer to the Discrete Read and Discrete Write tables in this manual for additional information on mapping of discrete read data to the PLC.

At the **Nbr of Scales?** prompt, press SELECT to display the number of scales to be interfaced (1, 2, 3, or 4).

If 1 or 2 Scales or No Scales Remote

- At the **Blk Transfer?** prompt, select Y(es) if the A-B RIO will communicate with the Jaguar terminal using block transfer. Select N(o) if block transfer is not required.

If 2 or More Scales

- At the **Scale N?** prompt, press SELECT to indicate if the designated scale is local or remote.
- For remote scales, select the terminal number (ARCnet™ node location) at the **Node?** prompt.
- At the **Internal Scale?** prompt, identify each scale as A or B.

3. Press ENTER to continue to the next sub-block or press ESCAPE to exit the setup mode.

Node Communications Sub-block

This manual does not attempt to give all information and configuration parameters for an Allen-Bradley network. Please refer to Allen-Bradley documentation for more information on specific network performance.

If block transfer is enabled steps 3 and 4 do not apply. Continue to step 5.

If enabled, block transfer always uses the first quarter. The first scale is the second quarter, and the second scale is the third quarter.

This sub-block lets you enter the Allen-Bradley RIO network communication parameters. The Jaguar programs the Node Adapter Chip with these parameters.

1. Press ENTER at the **Node Communicate** prompt to configure communications parameters.
2. At the **Rack Address?** prompt, use the numeric keys to input the rack address (01-64), then press ENTER.
3. At the **Start Quarter?** prompt, press SELECT to choose the starting quarter address (1-4).
4. At the **Last Rack?** prompt, select Y if the rack is the last quarter of this rack address, or N if it is not.
5. At the **Data Rate?** prompt, press SELECT to choose the appropriate baud rate (57.6k, 115.2k, 230.4k).

Reset to Factory Sub-block

Reset to Factory returns all parameters for this block to their original settings. You cannot reset a single value or specify only a few of the sub-block values.

If desired, you can reset all of the parameters for this program block to the original default values.

To reset the program block parameters:

1. Press ENTER at the **Reset to Factory** prompt.
2. At the **Are You Sure?** prompt, press SELECT to highlight Y(es) to confirm and reset the values to factory defaults, or select N(o) if you do not wish to reset the values.
3. Press ESCAPE to exit the sub-block.
4. Press SELECT to continue to another program block if desired.

AB RIO Interface PCB Wiring and Specifications

Processor: Allen-Bradley ASIC

Memory: None

I/O: Allen-Bradley RIO network interface
Electrical: centered, transformer isolated line drivers
Connector: Three position removable terminal strip

1 Blue
2 Shield
3 Clear

Bus Interface: Same as Connector PCB

Jumpers:

W1 Select IRQ3, IRQ4, IRQ5, IRQ6 or None

Position 1 to 2 IRQ7
Position 1 to 3 IRQ5
Position 1 to 4 IRQ4
Position 1 to 5 IRQ3 (default)

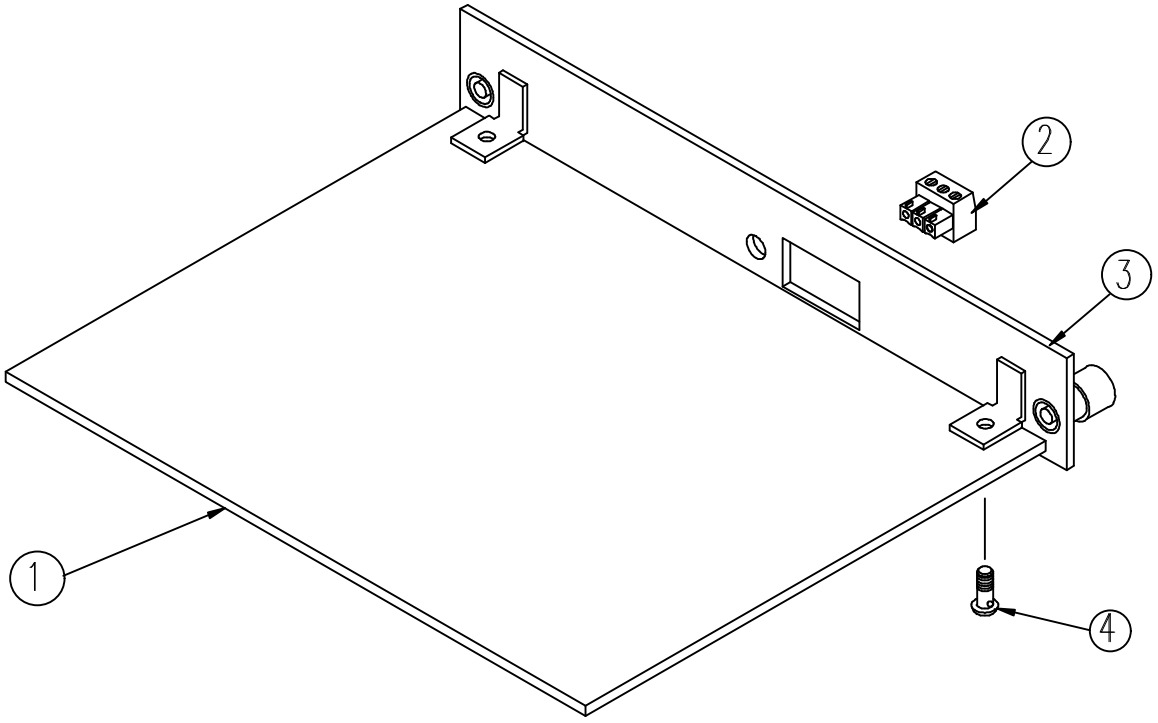
W2 IRQ pulldown. Install on only one board using a shared IRQ. (default = installed).

W3 Install to share an IRQ. (default = installed).

Power Requirements: +5 VDC

PCB Outline: 6.8" x 5.3". 0.50" max height.

Allen-Bradley RIO PCB Parts



Allen-Bradley RIO Assembly

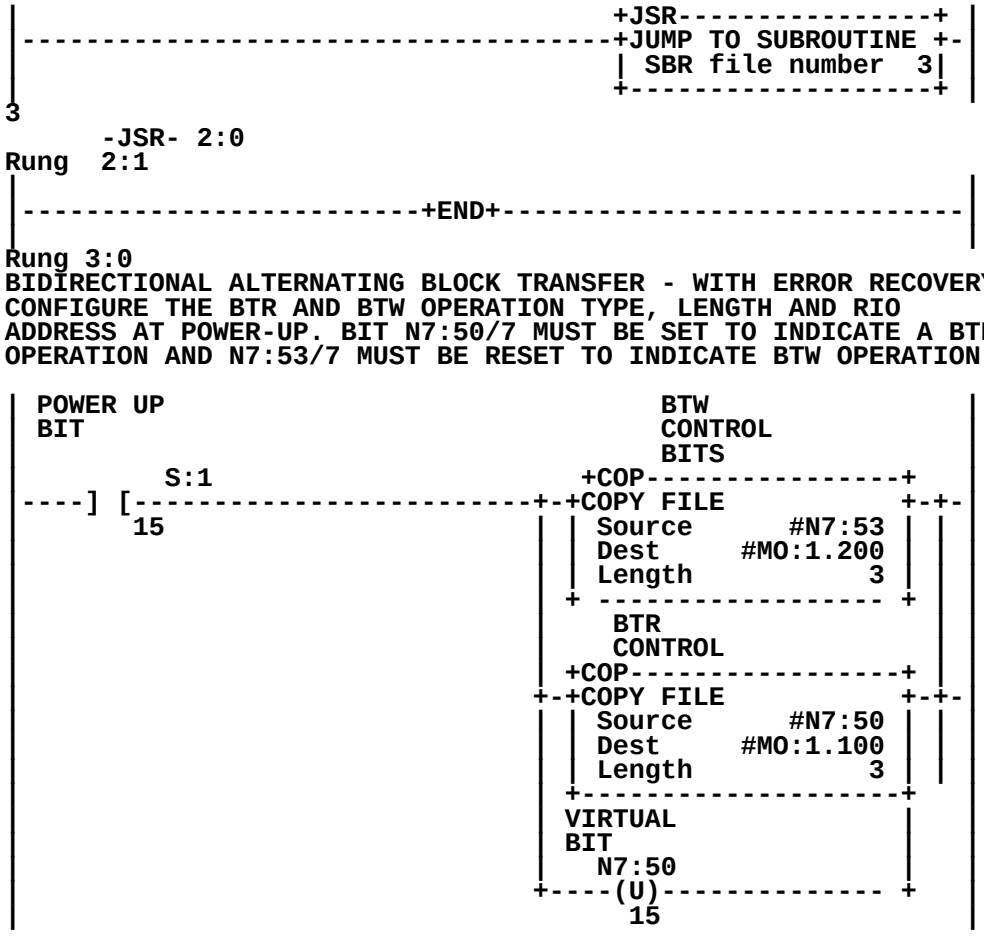
Ref #	Part Number	Description	QTY
1	A140934 00A	Allen-Bradley I/O PCB	1
2	142174 00A	Connector, 3 Position Terminal Block	1
3	141624 00A	Plate Assembly, Allen-Bradley I/O	1
4	R05111 00A	Screw, M4 X 10 Taptite	2
*	141634 00A	Allen-Bradley I/O PCB Panel Assembly	1

* Includes all parts listed above as an assembly.

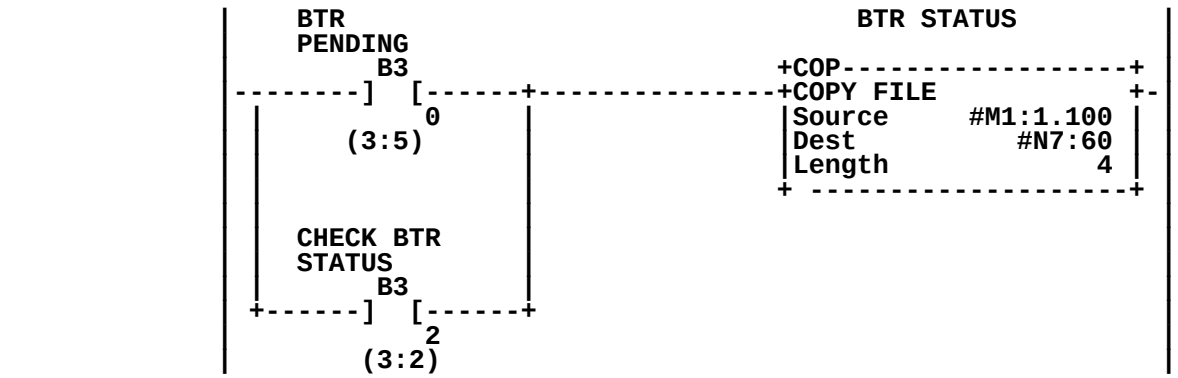
Interfacing Examples

The following pages show addressing examples for the AB Discrete and Block Transfer modes.

SLC Program Example

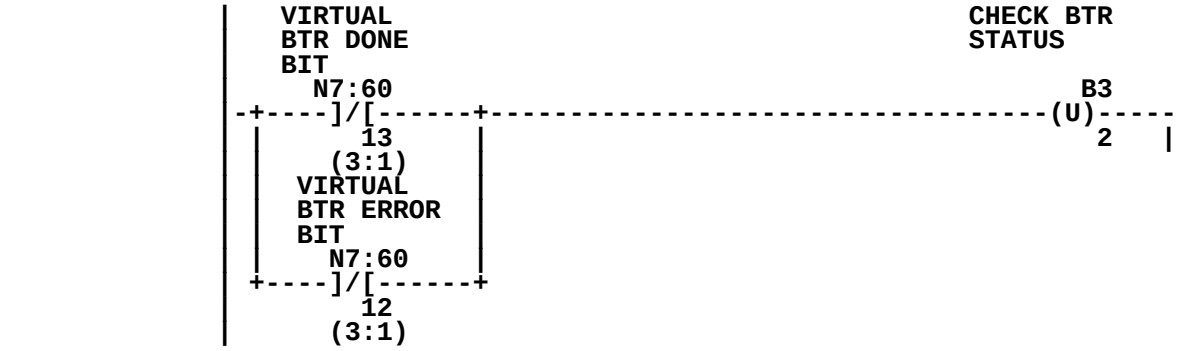


Rung 3:1
COPY THE BTR STATUS AREA TO AN INTEGER FILE ONLY WHEN A BTR IS IN PROGRESS. THIS STATUS DATA WILL THEN BE USED THROUGHOUT THE PROGRAM AND WILL LIMIT THE NUMBER OF M-FILE ACCESSES.



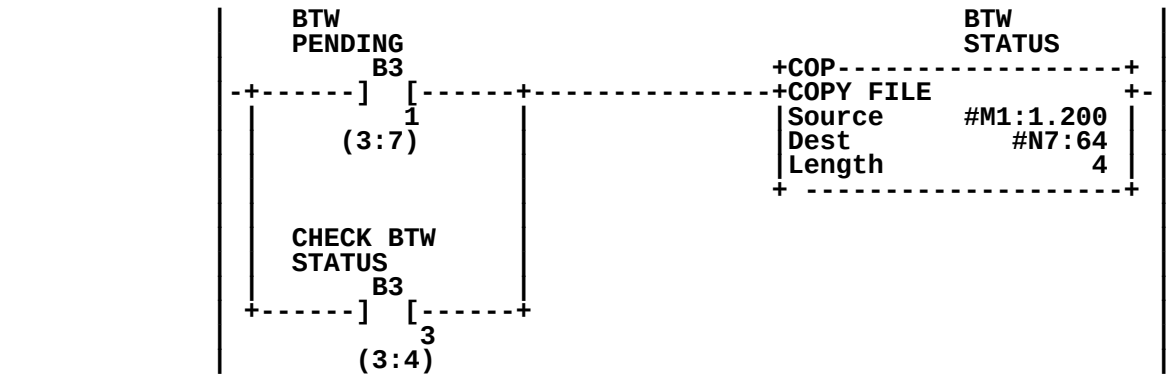

```
B3/0
      - ] [ -     3:1
      - (L) -     3:9
      - (U) -     3:5  3:6

B3/2
      - ] [ -     3:1
      - (L) -     3:5  3:6
      - (U) -     3:2

M1:1.100
      -COP- 3:1
N7:60
      -COP- 3:1
```

Rung 3:2
UNLATCH THE BIT THAT CONTINUES TO CHECK THE BTR STATUS. WHEN A BTR IS
COMPLETE, THE DONE BIT IS SET. THE LADDER PROGRAM MUST THEN UNLATCH THE ENABLE BIT, THEN WAIT FOR THE SN TO TURN OFF THE DONE BIT BEFORE ANOTHER BTR TO THE SAME M-FILE LOCATION CAN BE INITIATED. THIS IS ONE COMPLETE BTR CYCLE.




```
B3/2
      -] [- 3:1
      -(L)- 3:5  3:6
      -(U)- 3:2

N7:60/12
      -] [- 3:6  3:10
      -]/[- 3:2  3:9

N7:60/13
      -] [- 3:5  3:10
      -]/[- 3:2  3:9
```

Rung 3:3
COPY THE BTW STATUS AREA TO AN INTEGER FILE ONLY WHEN A BTW IS IN PROGRESS. THIS STATUS DATA WILL THEN BE USED THROUGHOUT THE PROGRAM AND WILL LIMIT THE NUMBER OF M-FILE ACCESSES.

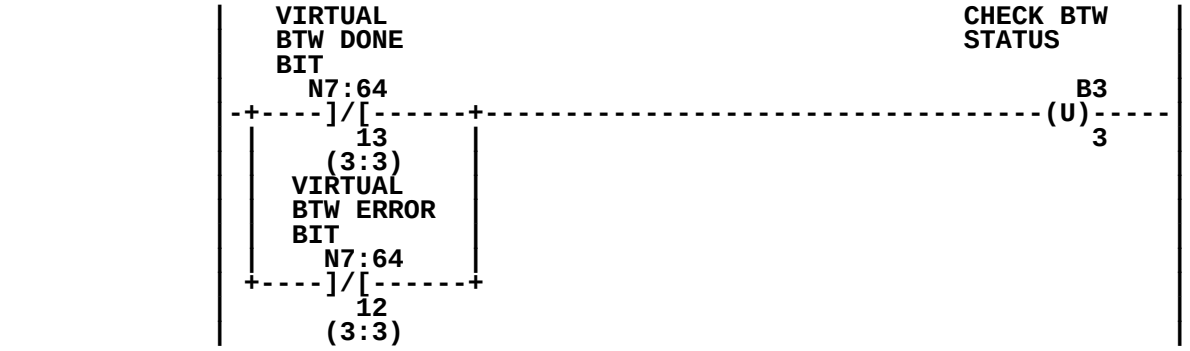


B3/1
-] [- 3:3
-(L)- 3:8
-(U)- 3:7

B3/3
-] [- 3:3
-(L)- 3:7
-(U)- 3:4

M1:1.200
-COP- 3:3
N7:64
-COP- 3:3

Rung 3:4
UNLATCH THE BIT THAT CONTINUES TO CHECK THE BTW STATUS. WHEN A BTW IS COMPLETE, THE DONE OR ERROR BIT IS SET. THE LADDER PROGRAM MUST THEN UNLATCH THE ENABLER BIT, THEN WAIT FOR THE SN MODULE TO TURN OFF THE DONE/ERROR BIT BEFORE ANOTHER BTW TO THE SAME M-FILE LOCATION CAN BE INITIATED. THIS COMPLETES THE ONE BTW CYCLE.

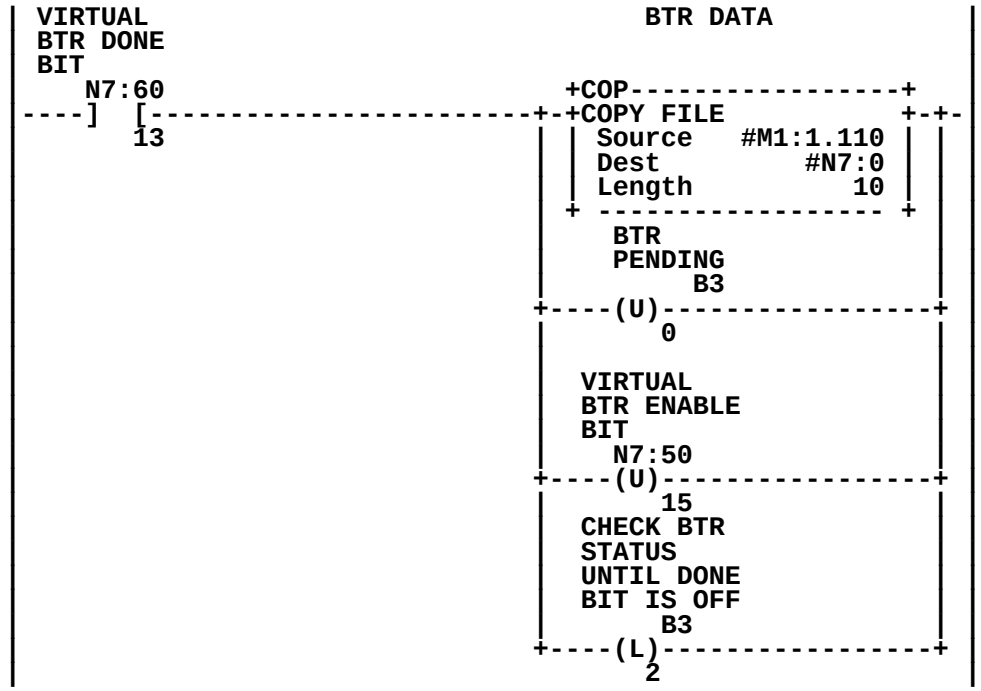


B3/3
-] [- 3:3
-(L)- 3:7
-(U)- 3:4

N7:64/12
-] [- 3:7 3:11
-]/[- 3:4 3:8

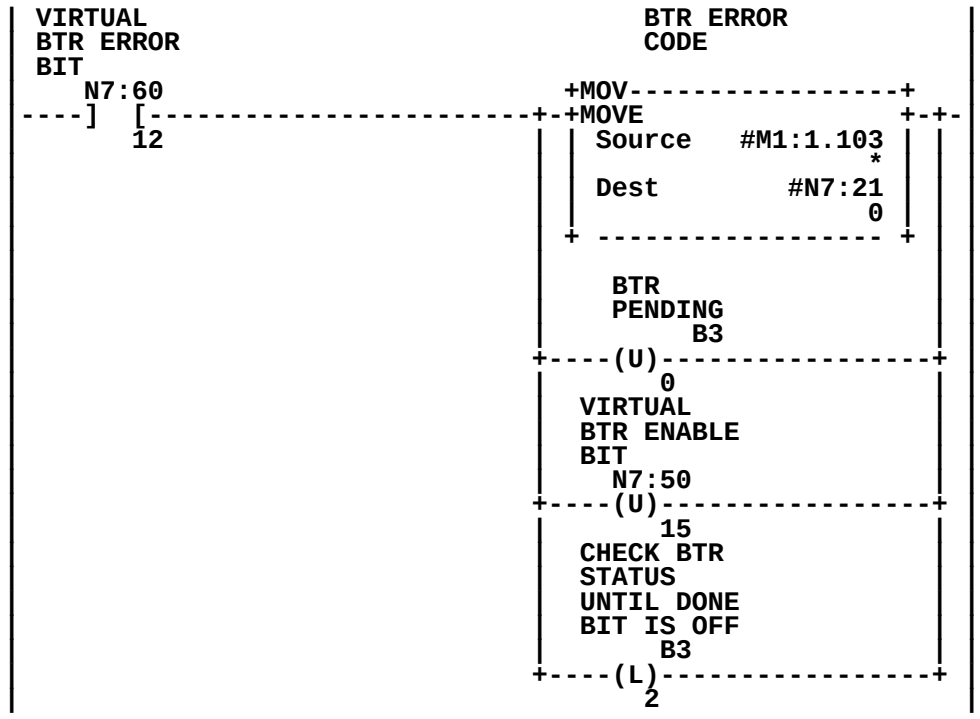
N7:64/13
-] [- 3:7 3:11
-]/[- 3:4 3:8

```
Rung 3:5
WHEN A BTR SUCCESSFULLY COMPLETES, BUFFER THE DATA AND UNLATCH
BOTH THE VIRTUAL BTR ENABLE BIT AND THE BTR PENDING BIT. ALSO,
LATCH ATHE BIT THAT CONTINUES CHECKING THE BTR STATUS UNTIL
THE SN MODULE TURNS OFF THE DONE BIT.
```



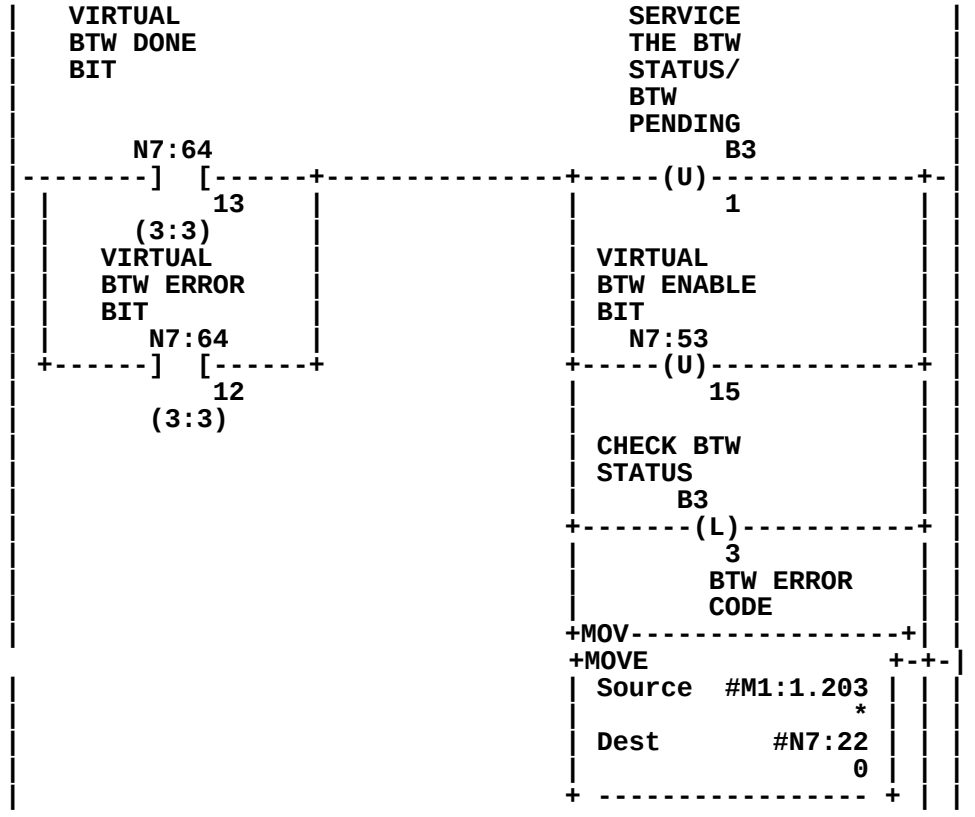

```
B3/0
      -] [- 3:1
      -(L)- 3:9
      -(U)- 3:5  3:6

B3/2
      -] [- 3:1
      -(L)- 3:5  3:6
      -(U)- 3:2

M1:1.110
      -COP- 3:5

N7:0
      -COP- 3:5

N7:50/15
      -] [- 3:10
      -]/[- 3:8  3:9
      -(L)- 3:9
      -(U)- 3:0  3:5  3:6

N7:60/13
      -] [- 3:5  3:10
      -]/[- 3:2  3:9
```

```
Rung 3:6
IF THE BTR FAILS, BUFFER THE BTR ERROR CODE AND UNLATCH THE
BTR ENABLE BIT AND THE BTR PENDING BIT. ALSO, LATCH THE CHECK
BTR STATUS BIT IN ORDER TO CONTINUE READING THE STATUS
INFORMATION FROM THE SCANNER UNTIL IT TURNS THE ERROR BIT OFF,
COMPLETING THE HAND SHAKE PROCESS.
```



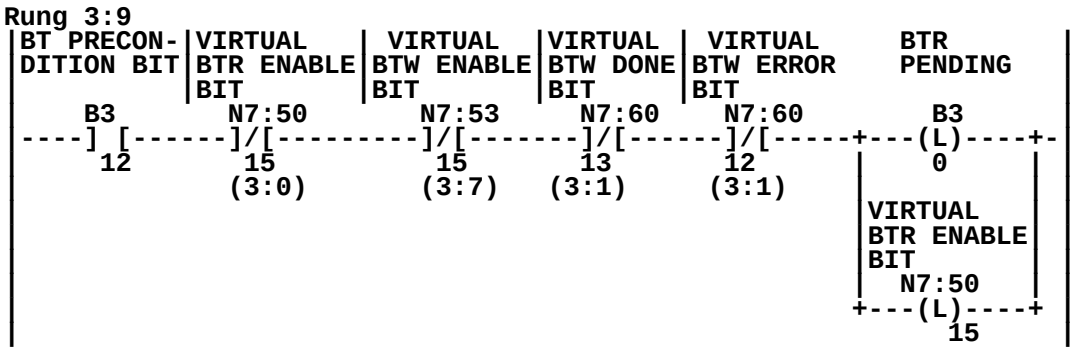

```
B3/0
      -] [- 3:1
      -(L)- 3:9
      -(U)- 3:5  3:6

B3/2
      -] [- 3:1
      -(L)- 3:5  3:6
      -(U)- 3:2

M1:1.103
      -MOV- 3:6

N7:21
      -MOV- 3:6

N7:50/15
      -] [- 3:10
      -]/[- 3:8  3:9
      -(L)- 3:9
      -(U)- 3:0  3:5  3:6

N7:60/12
      -] [-  3:5  3:10
      -]/[-  3:2  3:9
```

```
Rung 3:7
WHEN A BTW FAILS OR COMPLETES, UNLATCH THE BTW ENABLE BIT AND
THE BTW PENDING BIT TO COMPLETE A BTW SEQUENCE. ALSO, LATCH
THE BIT THAT CONTINUES CHECKING THE BTW STATUS UNTIL THE SN
MODULE TURNS THE DONE/ERROR BIT OFF.
```



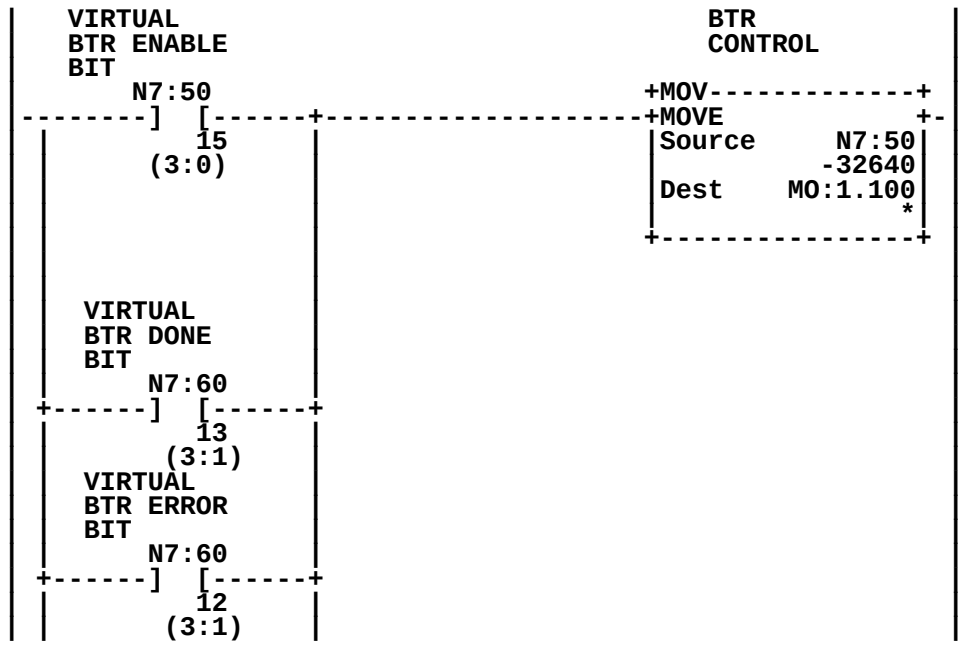

```
B3/1
      -] [- 3:3
      -(L)- 3:8
      -(U)- 3:7

B3/3
      -] [- 3:3
      -(L)- 3:7
      -(U)- 3:4

M1:1.203
      -MOV- 3:7

N7:22
      -MOV- 3:7

N7:53/15
      -] [- 3:11
      -]/[- 3:8  3:9
      -(L)- 3:8
      -(U)- 3:7

N7:64/13
      -] [- 3:7  3:11
      -]/[- 3:4  3:8
```

```
Rung 3:8
THIS RUNG AND THE NEXT ONE WILL TOGGLE BETWEEN EXECUTING A BTW
AND BTR WHILE THE USER SUPPLIED BT PRECONDITION BITS (B3/11
AND B3/12) ARE SET.

| BT PRECON-|VIRTUAL    | VIRTUAL    | VIRTUAL    | VIRTUAL
| DITION BIT|BTR ENABLE|BTW ENABLE|BTW DONE   |BTW ERROR
|           |BIT        |BIT       |BIT         |BIT
|    B3       N7:50        N7:53      N7:64       N7:64        >
|----] [-------]/[----------]/[-------]/[--------]/[--------->
|      11         15           15          13          12       >
|               (3:0)        (3:7)      (3:3)       (3:3)
|
|
|
|
|                                                              |
|                                  BTW DATA                    |
|                              <    +COP-----------------+      |
|                                --+-+COPY FILE          +-+-  |
|                              <   | | Source     #N11:0 | |   |
|                              <   | | Dest     #MO:1.210 | |   |
|                                  | | Length         64 | |   |
|                                  | + ---------------- + |   |
|                                  |                      |   |
|                                  | BTW                  |   |
|                                  | PENDING              |   |
|                                  |       B3             |   |
|                                  +----(L)---------------+   |
|                                  |       1              |   |
|                                  |                      |   |
|                                  |  VIRTUAL             |   |
|                                  |  BTW ENABLE          |   |
|                                  |  BIT                 |   |
|                                  |    N7:53             |   |
|                                  +----(L)---------------+ | |
|                                         15                 |

B3/1
      -] [-  3:3
      -(L)-  3:8
      -(U)-  3:7

B3/11
      -] [-  3:8

MO:1.210
      -] [- 3:10
      -]/[- 3:8  3:9
      -(L)- 3:9
      -(U)- 3:0  3:5  3:6

N7:53/15
      -] [- 3:11
      -]/[- 3:8  3:9
      -(L)- 3:8
      -(U)- 3:7

N7:64/12
      -] [- 3:7  3:11
      -]/[- 3:4  3:8

N7:64/13
      -] [- 3:7  3:11
      -]/[- 3:4  3:8

N11:0
      -COP-  3:8
```



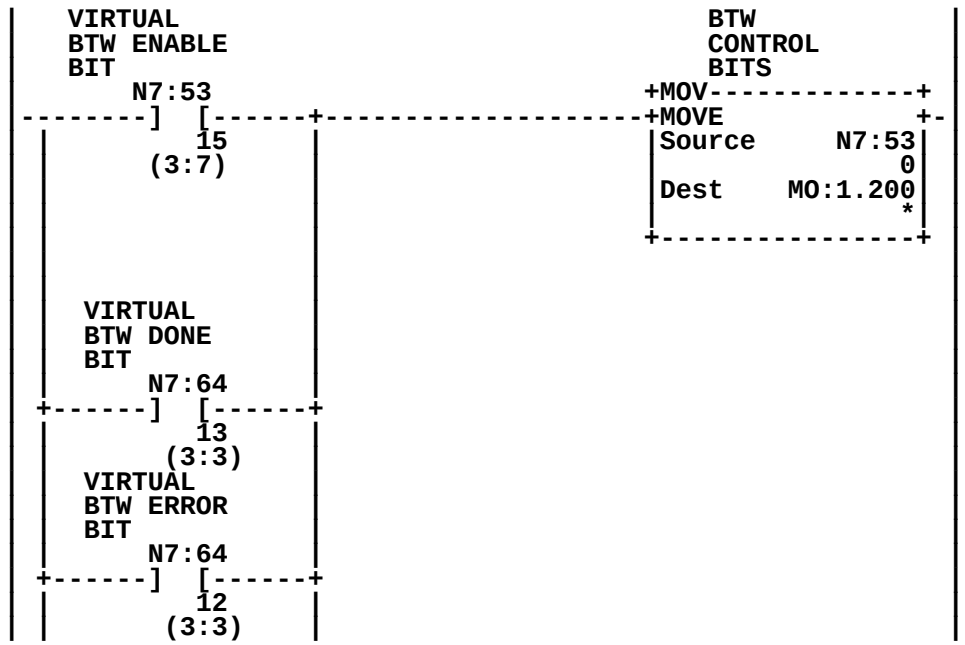

```
B3/0
      -] [-  3:1
      -(L)-  3:9
      -(U)-  3:5  3:6

B3/12
      -] [-  3:9

N7:50/15
      -] [- 3:10
      -]/[- 3:8  3:9
      -(L)- 3:9
      -(U)- 3:0  3:5  3:6

N7:53/15
      -] [- 3:11
      -]/[- 3:8  3:9
      -(L)- 3:8
      -(U)- 3:7

N7:60/12
      -] [- 3:6  3:10
      -]/[- 3:2  3:9

N7:60/13
      -] [- 3:5  3:10
      -]/[- 3:2  3:9
```

```
Rung 3:10
MOVE THE VIRTUAL BTR CONTROL WORD TO THE MO FILE FOR THE SN
MODULE WHILE A BTR IS IN PROGRESS, AND CONTINUE DOING SO UNTIL
THE ENABLE/DONE/ERROR BITS ARE ALL OFF.
```




```
MO:1.100
      -COP-  3:0
      -MOV-  3:10

N7:50
      -COP-  3:0
      -MOV-  3:10

N7:50/15
      -] [- 3:10
      -]/[- 3:8  3:9
      -(L)- 3:9
      -(U)- 3:0  3:5  3:6

N7:60/12
      -] [- 3:6  3:10
      -]/[- 3:2  3:9

N7:60/13
      -] [- 3:5  3:10
      -]/[- 3:2  3:9
```

```
Rung 3:11
MOVE THE VIRTUAL BTW CONTROL WORD TO THE MO FILE FOR THE SN
MODULE WHILE A BTW IS IN PROGRESS, AND CONTINUE DOING SO UNTIL
THE ENABLE/DONE/ERROR BITS ARE ALL OFF.
```




```
MO:1.200
      -COP-  3:0
      -MOV-  3:11

N7:53
      -COP-  3:0
      -MOV-  3:11

N7:53/15
      -] [- 3:11
      -]/[- 3:8  3:9
      -(L)- 3:8
      -(U)- 3:7

N7:64/12
      -] [- 3:7  3:11
      -]/[- 3:4  3:8

N7:64/13
      -] [- 3:7  3:11
      -]/[- 3:4  3:8
```

```
Rung 3:12
|-------------------------+END+--------------------------|
```

1747-SN G File Screen Dump

address	15	data		0	address	data 0
G1:0	001	000	001	0000		
	0	0	0			
G1:1	000	000	000	0001		
	0	0	0			
G1:2	000	000	000	0011		
	0	0	0			
G1:3	000	000	000	0000		
	0	0	0			

```
Data Table              Processor File: METTLER.ACH        Data Table File S2
ARITHMETIC FLAGS  S:0          Z:0    V:0    C:0

PROCESSOR STATUS  00000000  00000000      SUSPEND CODE                        0
PROCESSOR STATUS  00000000  10000110      SUSPEND FILE                        0
PROCESSOR STATUS  10010000  00010010
                                          WATCHDOG                [x10 ms]: 10
MINOR FAULT       01000000  00000000      LAST SCAN               [x10 ms]:  1
FAULT CODE                     0000      FREE RUNNING CLOCK  00001101 11101000
FAULT DESCRIPTION:

MATH REGISTER              0000 0000

ACTIVE NODE LIST        (CHANNEL 1)       I/O SLOT ENABLES

0          10         20         30       0         10          20        30
11000000 00000000 00000000 00000000       11111111 11111111 11111111 11111111

PROCESSOR BAUD RATE (CHANNEL 1) 19200     PROCESSOR ADDRESS   (CHANNEL 1)    1

LAST SCAN               [x01 ms]:   6      I/O SLOT INTERRUPT ENABLES
LAST SCAN               [x10 ms]:   1      0         10         20         30
1 ms TIMEBASE (SCAN Times)          0      11111111 11111111 11111111 11111111
AVERAGE SCAN            [x10 ms]:   0
MAXIMUM SCAN            [x10 ms]:   6
                                          I/O SLOT INTERRUPT PENDING
INDEX REGISTER VALUE:               0     0         10         20         30
INDEX ACROSS FILES:                NO     00000000 00000000 00000000 00000000

FAULT ROUTINE SUBROUTINE FILE:      0     I/O INTERRUPT FILE EXEC:

SELECTABLE TIMED INTERRUPT                SINGLE STEP TEST           FILE  RUNG
  SUBROUTINE FILE:                  0       START STEP ON:              2     0
  SETPOINT              [x10 ms]:   0       END STEP BEFORE:            0     0
  ENABLED:                          1       FAULT/POWER DOWN:           3     9
  EXECUTING:                        0       COMPILED FOR SINGLE STEP:         YES
  PENDING:                          0
  1 ms TIMEBASE                     0     STI LOST:                           0
```

```
Data Table              Processor File: METTLER.ACH         Data Table File S2

EXT PROCESSOR STATUS 00000010 00000000    REAL TIME CLOCK DATE:   03-13-1997
EXT MINOR FAULT      00000000 00000000                    TIME:     03:23:39

DISCRETE INPUT INTERRUPT
  SUBROUTINE FILE:                0     MASK:                    00000000
  INPUT SLOT:                     0     COMPARE VALUE:           00000000
  ENABLED:                        1     PRESET:                         0
  EXECUTING:                      0     RETURN MASK:             00000000
  PENDING:                        0     ACCUMULATOR:                    0
  OVERFLOW:                       0     LAST SCAN [ms]:                 0
  LOST:                           0     MAX. SCAN [ms]:                 0

PROCESSOR                     OPERATING SYSTEM        USER PROGRAM
  CATALOG #:            532     CATALOG #:      300          FUNCTIONAL TYPE:   1
  SERIES:                 B     SERIES:     A           FUNCTIONAL INDEX: 65
  REVISION:               2     F.R.N.:     2
  USER RAM SIZE:         64
  FLASH EEPROM SIZE:    480
                                    EXT PROCESSOR STATUS:  00000000 00000000
CHANNEL 0 ACTIVE NODE TABLE

          0         10         20         30
  0- 31  00000000 00000000 00000000 00000000
 32- 63  00000000 00000000 00000000 00000000
 64- 95  00000000 00000000 00000000 00000000          10 us DII TIMER:     0
 96-127  00000000 00000000 00000000 00000000          10 us STI TIMER:     0
128-159  00000000 00000000 00000000 00000000          10 us I/O TIMER:     0
160-191  00000000 00000000 00000000 00000000
192-223  00000000 00000000 00000000 00000000
224-255  00000000 00000000 00000000 00000000

Data Table              Processor File: METTLER.ACH         Data Table File N7

Address     Data  (Radix=DECIMAL)
N7:0      8224    8311    2975   12592   17780   -24576    8224    8300   26996   12337
N7:10        0   16705       0       0       0        0       0       0       0    8224
N7:20        0       0       0       0       0        0       0       0       0       0
N7:30        0       0       0       0       0        0       0       0       0       0
N7:40        0       0       0       0       0        0       0       0       0       0
N7:50   -32640      64       0       0      64        0       0       0       0       0
N7:60    17408       0       0       0       0        0       0       0       0       0
N7:70        0       0       0       0       0       47       0       0       0       0
```

N7 SCREEN DUMP (ASCII)

address	0	1	2	3	4	5	6	7	8	9
N7:0		w	t 1	1 0	E t	\A0/00		l	j t	0 1
N7:10	\00\00	A A	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00
N7:20	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00
N7:30	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00
N7:40	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00	\00\00
N7:50	\80\80	\00 @	\00\00	\00\00	\00 @	\00\00	\00\00	\00\00	\00\00	\00\00
N7:60	D \00	\00\00	\00\00	\00\00	\00\00	\00 /	\00\00	\00\00	\00\00	\00\00
N7:70	\00\00	\00\00	\00\00	\00\00						

Data Table Processor File: METTLER.ACH Data Table File N10

Address	Data	(Radix=DECIMAL)								
N10:0	2	0	3	0	0	0	0	0	1	3
N10:10	0	0	0	0	0	0	0	0	0	0
N10:20	0	0	0	0	0	0	0	0	0	0
N10:30	0	0								

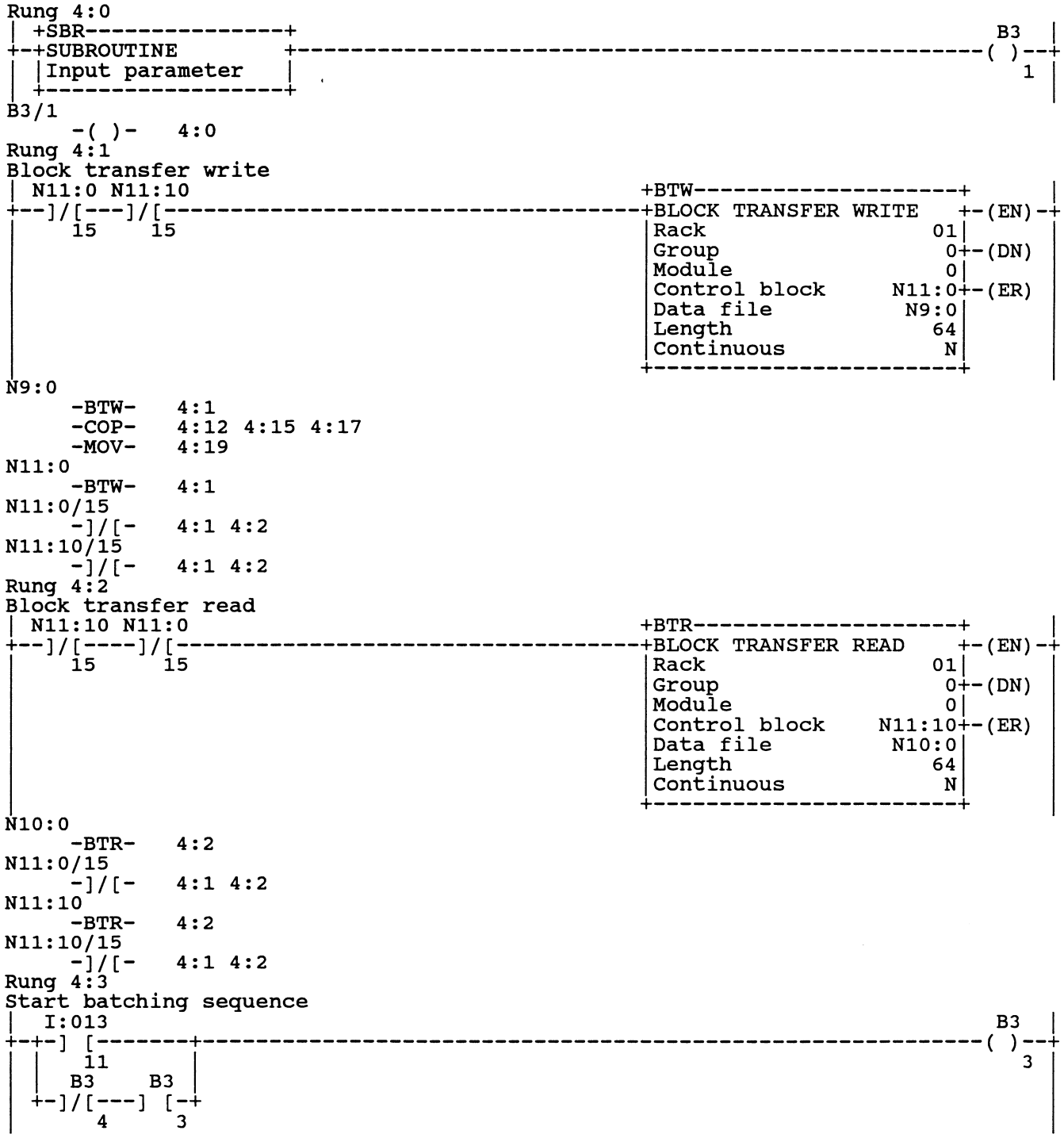
Data Table Processor File: METTLER.ACH Data Table File N11

Address	Data	(Radix=DECIMAL)								
N10:0	0	0	3	0	0	0	0	0	1	3
N10:10	8307	28721	12341	0	0	8224	8300	26996	12338	0
N10:20	0	0	0	0	0	0	0	0	0	0
N10:30	0	0	0	0	0	0	0	0	0	8224
N10:40	8311	29745	12592	8224	8300	26996	12337	0	0	0
N10:50	0	0	0	0	0	0	0	0	0	0
N10:60	0	0	0	0	0	0	0	0	0	0
N10:70	0	0	0	0	0	0	0	0	0	0
N10:80	0	0	0	0	0	0	0	0	0	0
N10:90	0	0	0	0	0	0	0	0	0	0
N10:100	0									

Data Table Processor File: METTLER.ACH Data Table File N12

Address	Data	(Radix=DECIMAL)								
N12:0	8224	8311	29745	12592	17880	-24576	8224	8300	26996	12337
N12:10	19276	20291	19278	17746	8272	17742	21550	8224	0	0
N12:20	0	0	0	0	0	0	0	0	12336	8224
N12:30	0	0	0	0	0	0	0	0	0	8224
N12:40	8311	29745	12592	8224	8300	26996	12337	0	0	0
N12:50	0	0	0	0	0	0	0	0	0	0
N12:60	0	0	0	0	0	0	0	0	0	0
N12:70	0	0	0	0	0	0	0	0	0	0
N12:80	0	0	0	0	0	0	0	0	0	0
N12:90	0	0	0	0	0	0	0	0	0	0
N12:100	0									

PLC-5 Block Transfer Program Example

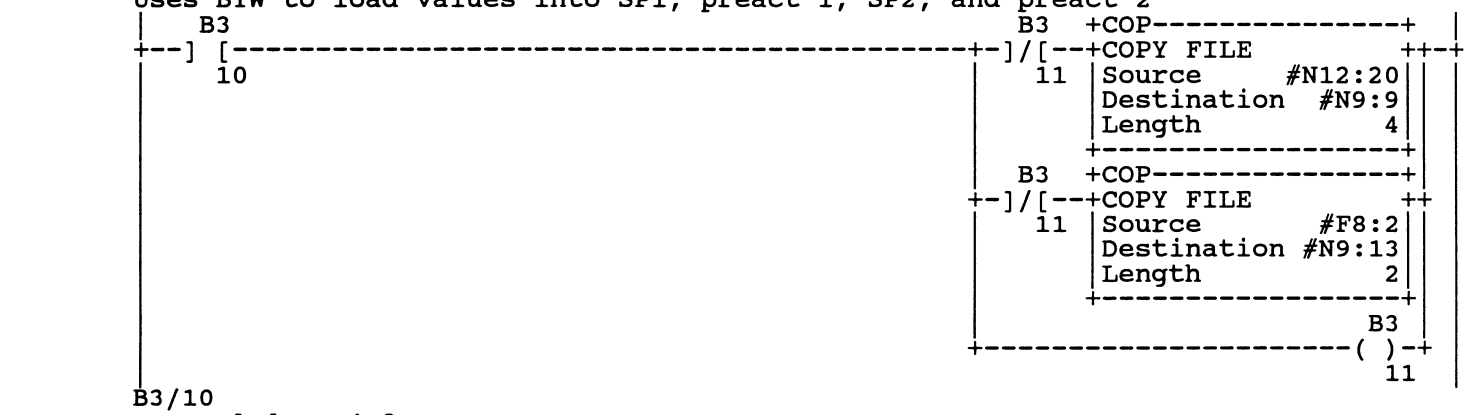


```
B3/3
     -] [-   3:1 3:2 3:3 3:4 3:6 3:7 3:10 4:3 4:4 4:5 4:6 4:11
     -]/[-   3:13 4:19
     -( )-   3:1 4:3
B3/4
     -] [-   3:13 4:19
     -]/[-   3:1 3:2 3:5 4:3 4:4 4:7 4:13 4:16
     -( )-   3:12 4:18
I:013/11
     -] [-   4:3
Rung 4:4
Checks to see if scale = 0
|    B3  +EQU---------------+                                                  B3  |
+--] [-++EQUAL               ++----------------------------------------------( )--+
|      3||Source A  0.000000||                                                 2   |
|       ||                  ||                                                     |
|       ||Source B     F8:12||                                                     |
|       ||            1.000000|                                                   |
|       |+------------------+|                                                    |
|       |+GRT---------------+|                                                    |
|       ++GREATER THAN       ++                                                   |
|       ||Source A     F8:12||                                                    |
|       ||            1.000000|                                                  |
|       ||Source B     F18:1||                                                    |
|       ||            10.00000|                                                  |
|       |+------------------+|                                                    |
|       |  B3    B3           |                                                   |
|       +-] [---]/[----------+                                                    |
|           2     4                                                               |
B3/2
     -] [-   3:2 3:4 4:4 4:6
     -]/[-   3:3 4:5
     -( )-   3:2 4:4
B3/3
     -] [-   3:1 3:2 3:3 3:4 3:6 3:7 3:10 4:3 4:4 4:5 4:6 4:11
     -]/[-   3:13 4:19
     -( )-   3:1 4:3
B3/4
     -] [-   3:13 4:19
     -]/[-   3:1 3:2 3:5 4:3 4:4 4:7 4:13 4:16
     -( )-   3:12 4:18
F8:12
     -CPT-   2:1 2:2 2:4 2:5 2:6 2:7
     -EQU-   3:2 3:7 4:4
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4 4:14
     -LEQ-   3:3 3:12 4:5 4:14 4:18
     -NEQ-   3:3 4:5
F18:1
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4
     -LEQ-   3:3 3:12 4:5 4:18
```

```
Rung 4:5
Zeros scale if not zero and within acceptable zero range
|    B3  +NEQ---------------+ +LEQ---------------+   B3                    O:013 |
+--] [--+NOT EQUAL          +-+LESS THAN OR EQUAL+--]/[--------------------( )--+
|      3 |Source A  0.000000| |Source A     F8:12|     2                     07 |
|        |                  | |            1.000000|                          |
|        |Source B     F8:12| |Source B     F18:1|                           |
|        |           1.000000| |           10.00000|                          |
|        +-------------------+ +-------------------+                          |
|
B3/2
     -] [-   3:2 3:4 4:4 4:6
     -]/[-   3:3 4:5
     -( )-   3:2 4:4
B3/3
     -] [-   3:1 3:2 3:3 3:4 3:6 3:7 3:10 4:3 4:4 4:5 4:6 4:11
     -]/[-   3:13 4:19
     -( )-   3:1 4:3
F8:12
     -CPT-   2:1 2:2 2:4 2:5 2:6 2:7
     -EQU-   3:2 3:7 4:4
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4 4:14
     -LEQ-   3:3 3:12 4:5 4:14 4:18
     -NEQ-   3:3 4:5
F18:1
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4
     -LEQ-   3:3 3:12 4:5 4:18
O:013/07
     -( )-   4:5
Rung 4:6
|   B3    B3    B3                                          +MOV---------------+  |
+--] [---] [---]/[-----------------------------------------++MOVE               ++-+
|     3     2     5                                        ||Source      N11:20||  |
|                                                          ||                250||  |
|                                                          ||Destination  O:012||  |
|                                                          ||                250||  |
|                                                          |+-------------------+|  |
|                                                          |               O:013|  |
|                                                          +----------    ---( )-+  |
|                                                                           03    |
B3/2
     -] [-   3:2 3:4 4:4 4:6
     -]/[-   3:3 4:5
     -( )-   3:2 4:4
B3/3
     -] [-   3:1 3:2 3:3 3:4 3:6 3:7 3:10 4:3 4:4 4:5 4:6 4:11
     -]/[-   3:13 4:19
     -( )-   3:1 4:3
B3/5
     -] [-   3:6 3:7 4:11
     -]/[-   3:4 4:6
     -( )-   3:5 4:7
N11:20
     -MOV-   3:4 4:6
```

```
O:012
     -MOV-   4:6
O:013/03
     -( )-   4:6
Rung 4:7
Checks for net mode bit then turns on tare complete
| I:013   B3    B3                                                                  B3   |
+--] [---]/[---]/[-------------------------------------------------------------+-------( )-+-+
|     15     4     8                                                          |          5| |
|                                                                             |O:013 O:013| |
|                                                                             +-]/[---( )-+ |
|                                                                                 17    00  |
B3/4
     -] [-   3:13 4:19
     -]/[-   3:1 3:2 3:5 4:3 4:4 4:7 4:13 4:16
     -( )-   3:12 4:18
B3/5
     -] [-   3:6 3:7 4:11
     -]/[-   3:4 4:6
     -( )-   3:5 4:7
B3/8
     -] [-   2:11 2:12 2:13 3:10 3:11 3:12 4:16 4:17 4:18
     -]/[-   2:13 3:4 3:8 4:7 4:12 4:13 4:15
     -( )-   3:10 4:16
I:013/15
     -] [-   4:7 4:17
O:013/00
     -( )-   4:7
O:013/17
     -]/[-   4:7
Rung 4:8
Uses BTW to load values into SP1, preact 1, SP2, and preact 2
|   B3                                                  B3  +COP---------------+   |
+--] [------------------------------------------------+-]/[--+COPY FILE          ++-+
|     11                                               |     6 |Source     #N12:30|| |
|                                                      |       |Destination  #N9:9|| |
|                                                      |       |Length            4|| |
|                                                      |       +------------------+| |
|                                                      |  B3  +COP---------------+| |
|                                                      +-]/[--+COPY FILE          ++ |
|                                                      |     6 |Source       #F8:3|| |
|                                                      |       |Destination #N9:13|| |
|                                                      |       |Length            2|| |
|                                                      |       +------------------+| |
|                                                      |                        B3  | |
|                                                      +----------------------( )-+ |
|                                                                                  6  |
B3/6
     -] [-   3:7 3:8 4:12 4:13
     -]/[-   3:6 4:8 4:8
     -( )-   3:7 4:8
B3/11
     -] [-   4:8
     -]/[-   4:9 4:9
     -( )-   4:9
```

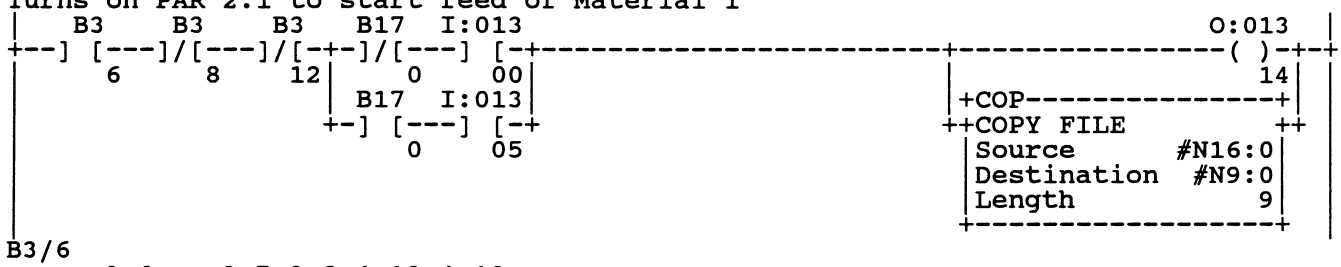
```
F8:3
     -COP-   4:8
N9:9
     -COP-   4:8 4:9 4:10 4:11
N9:13
     -COP-   4:8 4:9 4:10 4:11
N12:30
     -COP-   4:8
Rung 4:9
Uses BTW to load values into SP1, preact 1, SP2, and preact 2
```




```
B3/10
     -] [-   4:9
     -]/[-   4:10 4:10
     -( )-   4:10
B3/11
     -] [-   4:8
     -]/[-   4:9 4:9
     -( )-   4:9
F8:2
     -COP-   4:9
N9:9
     -COP-   4:8 4:9 4:10 4:11
N9:13
     -COP-   4:8 4:9 4:10 4:11
N12:20
     -COP-   4:9
```

```
Rung 4:10
Uses BTW to load values into SP1, preact 1, SP2, and preact 2
|    B3                                                B3  +COP---------------+   |
+--] [-----------------------------------------------+-]/[--+COPY FILE          ++-+
|     9                                               |    10 |Source     #N12:10|| |
|                                                     |       |Destination  #N9:9|| |
|                                                     |       |Length            4|| |
|                                                     |       +------------------+| |
|                                                     |  B3  +COP---------------+| |
|                                                     +-]/[--+COPY FILE          ++ |
|                                                     |    10 |Source       #F8:1|| |
|                                                     |       |Destination #N9:13|| |
|                                                     |       |Length            2|| |
|                                                     |       +------------------+| |
|                                                     |                       B3 | |
|                                                     +----------------------( )-+ |
|                                                                              10   |
B3/9
     -] [-   4:10
     -]/[-   4:11 4:11
     -( )-   4:11
B3/10
     -] [-   4:9
     -]/[-   4:10 4:10
     -( )-   4:10
F8:1
     -COP-   4:10
N9:9
     -COP-   4:8 4:9 4:10 4:11
N9:13
     -COP-   4:8 4:9 4:10 4:11
N12:10
     -COP-   4:10
Rung 4:11
Uses BTW to load values into SP1, preact 1, SP2, and preact 2
|    B3    B3                                          B3  +COP---------------+   |
+--] [---] [-----------------------------------------+-]/[--+COPY FILE          ++-+
|     3     5                                         |    9  |Source     #N12:0|| |
|                                                     |       |Destination  #N9:9|| |
|                                                     |       |Length            4|| |
|                                                     |       +------------------+| |
|                                                     |  B3  +COP---------------+| |
|                                                     +-]/[--+COPY FILE          ++ |
|                                                     |    9  |Source       #F8:0|| |
|                                                     |       |Destination #N9:13|| |
|                                                     |       |Length            2|| |
|                                                     |       +------------------+| |
|                                                     |                       B3 | |
|                                                     +----------------------( )-+ |
|                                                                              9    |
B3/3
     -] [-   3:1 3:2 3:3 3:4 3:6 3:7 3:10 4:3 4:4 4:5 4:6 4:11
     -]/[-   3:13 4:19
     -( )-   3:1 4:3
B3/5
```

```
B3/5
     -] [-   3:6 3:7 4:11
     -]/[-   3:4 4:6
     -( )-   3:5 4:7
B3/9
     -] [-   4:10
     -]/[-   4:11 4:11
     -( )-   4:11
F8:0
     -COP-   4:11
N9:9
     -COP-   4:8 4:9 4:10 4:11
N9:13
     -COP-   4:8 4:9 4:10 4:11
N12:0
     -COP-   4:11
Rung 4:12
Turns on PAR 2.1 to start feed of Material 1
```




```
B3/6
     -] [-   3:7 3:8 4:12 4:13
     -]/[-   3:6 4:8 4:8
     -( )-   3:7 4:8
B3/8
     -] [-   2:11 2:12 2:13 3:10 3:11 3:12 4:16 4:17 4:18
     -]/[-   2:13 3:4 3:8 4:7 4:12 4:13 4:15
     -( )-   3:10 4:16
B3/12
     -] [-   4:13 4:14
     -]/[-   4:12
     -( )-   4:13
B17/0
     -] [-   2:0 2:1 2:2 2:3 2:4 2:5 3:10 4:12 4:13 4:15 4:16
     -]/[-   2:6 2:7 3:10 4:12 4:13 4:15 4:16
I:013/00
     -] [-   4:12
     -]/[-   4:13
I:013/05
     -] [-   4:12
     -]/[-   4:13
N9:0
     -BTW-   4:1
     -COP-   4:12 4:15 4:17
     -MOV-   4:19
N16:0
     -COP-   4:12
O:013/14
```

```
O:013/14
     -] [-   2:11 2:12 2:13
     -( )-   4:12
Rung 4:13
Setpoint 1 feed done
|     B3    B3   B17  I:013                                                B3  |
+-+-] [---]/[-+-]/[---]/[-++-----------------------------------------------( )--+
| |     6     8|     0    00||                                               12  |
| |            |  17  I:013||                                                   |
| |            +-] [---]/[-+|                                                   |
| |                  0    05 |                                                  |
| |  B3    B3               |                                                  |
| +-] [---]/[---------------+                                                  |
|      12     4                                                                |
B3/4
     -] [-   3:1^ 4:19
     -]/[-   3:1 ,:2 3:5 4:3 4:4 4:7 4:13 4:16
     -( )-   3:12 4:18
B3/6
     -] [-   3:7 3:8 4:12 4:13
     -]/[-   3:6 4:8 4:8
     -( )-   3:7 4:8
B3/8
     -] [-   2:11 2:12 2:13 3:10 3:11 3:12 4:16 4:17 4:18
     -]/[-   2:13 3:4 3:8 4:7 4:12 4:13 4:15
     -( )-   3:10 4:16
B3/12
     -] [-   4:13 4:14
     -]/[-   4:12
     -( )-   4:13
B17/0
     -] [-   2:0 2:1 2:2 2:3 2:4 2:5 3:10 4:12 4:13 4:15 4:16
     -]/[-   2:6 2:7 3:10 4:12 4:13 4:15 4:16
I:013/00
     -] [-   4:12
     -]/[-   4:13
I:013/05
     -] [-   4:12
     -]/[-   4:13
```

```
Rung 4:14
Uses discrete write tare bit to tare first material weight
|    B3                                  +LEQ---------------+                B3    |
+--] [---------------------------------++LESS THAN OR EQUAL++-----------( )-+-+
|    12                                 |||Source A     F8:12||               13| | |
|                                       |||              1.000000||                 | | |
|                                       |||Source B  0.000000||                 | | |
|                                       ||+-------------------+|                 | | |
|                                       ||  B3                 |                 | | |
|                                       |+-] [-----------------+                 | | |
|                                       |    13                                  | | |
|                                       | T4:1   B3  +GRT---------------+ O:013| | |
|                                      +-] [---]/[--+GREATER THAN      +--( )-+ | |
|                                         DN    13 |Source A     F8:12|    05  | | |
|                                                  |              1.000000|        | | |
|                                                  |Source B  0.000000|        | | |
|                                                  |                  |        | | |
|                                                  +------------------+        | | |
|                                                                              | | |
B3/12
     -] [-   4:13 4:14
     -]/[-   4:12
     -( )-   4:13
B3/13
     -] [-   4:14 4:15 4:16
     -]/[-   4:14
     -( )-   4:14
F8:12
     -CPT-   2:1 2:2 2:4 2:5 2:6 2:7
     -EQU-   3:2 3:7 4:4
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4 4:14
     -LEQ-   3:3 3:12 4:5 4:14 4:18
     -NEQ-   3:3 4:5
O:013/05
     -( )-   4:14
T4:1
     -TON-   2:9
T4:1.DN
     -] [-   4:14
     -]/[-   2:9
Rung 4:15
Turns on PAR 2.2 to start Material 2 feed
|   B3   B17  I:013   B3                                                  O:013  |
+--] [-+-]/[---] [-+-]/[-------------------------------+----------------( )-+-+
|    13|     0    01|    8                             |                  15| | |
|      | B17  I:013|                                  |+COP--------------+| | |
|      +-] [---] [-+                                 ++COPY FILE         ++ | |
|           0    06                                   |Source     #N16:10|  | |
|                                                     |Destination  #N9:0|  | |
|                                                     |Length            9|  | |
|                                                     +------------------+  | |
B3/8
     -] [-   2:11 2:12 2:13 3:10 3:11 3:12 4:16 4:17 4:18
     -]/[-   2:13 3:4 3:8 4:7 4:12 4:13 4:15
```

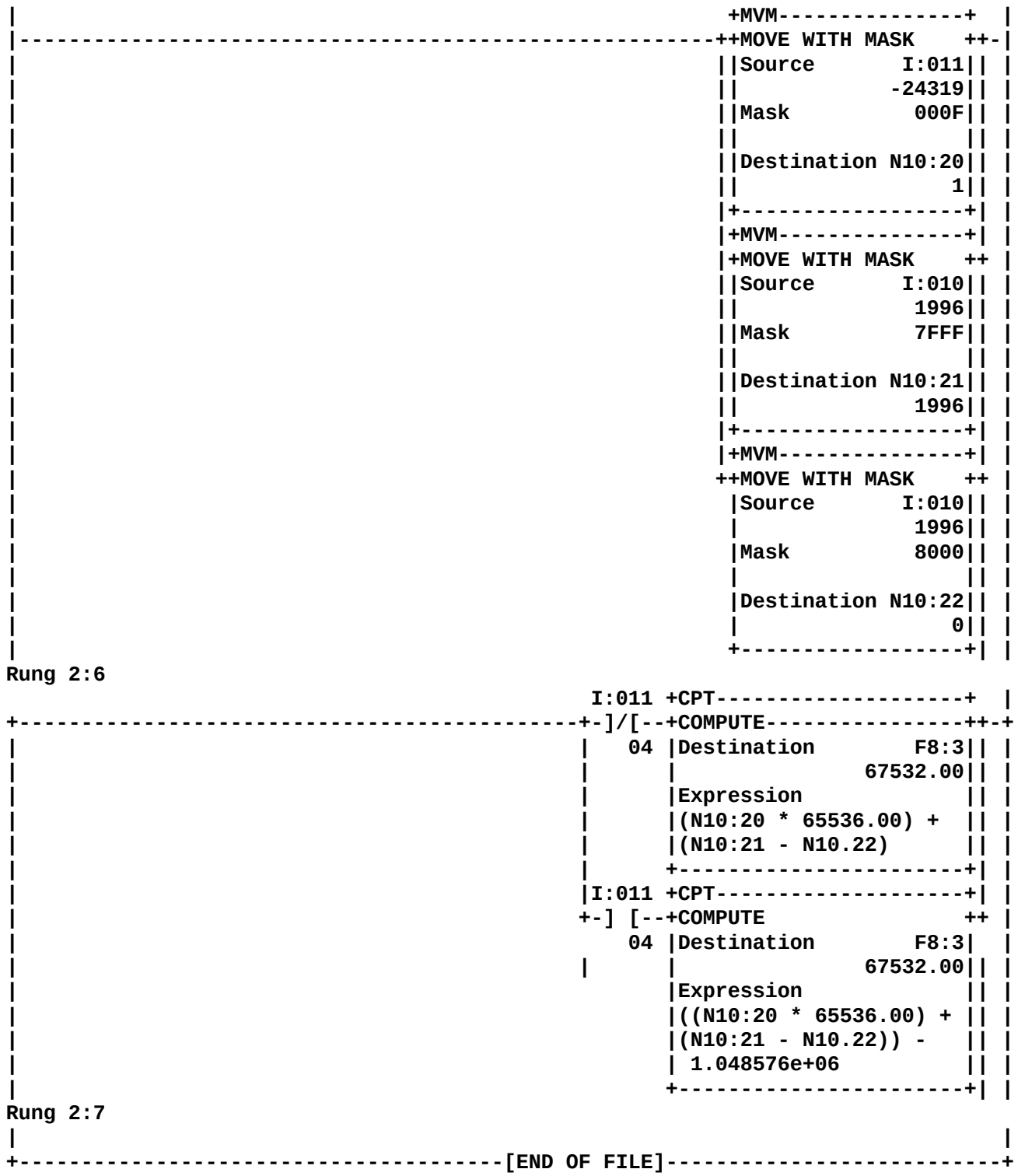
```
B3/8
     -( )-   3:10 4:16
B3/13
     -] [-   4:14 4:15 4:16
     -]/[-   4:14
     -( )-   4:14
B17/0
     -] [-   2:0 2:1 2:2 2:3 2:4 2:5 3:10 4:12 4:13 4:15 4:16
     -]/[-   2:6 2:7 3:10 4:12 4:13 4:15 4:16
I:013/01
     -] [-   4:15
     -]/[-   4:16
I:013/06
     -] [-   4:15
     -]/[-   4:16
N9:0
     -BTW-   4:1
     -COP-   4:12 4:15 4:17
     -MOV-   4:19
N16:10
     -COP-   4:15
O:013/15
     -] [-   2:11 2:12 2:13
     -( )-   4:15
Rung 4:16
Checks the discrete setpoint input bit for feed done
|     B3   B17  I:013                                                  B3  |
+-+-] [-+-]/[---]/[-++-----------------------------------------------( )--+
| |    13|     0    01||                                               8  |
| |      | B17  I:013||                                                   |
| |      +-] [---]/[-+|                                                   |
| |         0    06  |                                                   |
| |  B3     B3       |                                                   |
| +-] [---]/[--------+                                                   |
|      8     4                                                           |
B3/4
     -] [-   3:13 4:19
     -]/[-   3:1 3:2 3:5 4:3 4:4 4:7 4:13 4:16
     -( )-   3:12 4:18
B3/8
     -] [-   2:11 2:12 2:13 3:10 3:11 3:12 4:16 4:17 4:18
     -]/[-   2:13 3:4 3:8 4:7 4:12 4:13 4:15
     -( )-   3:10 4:16
B3/13
     -] [-   4:14 4:15 4:16
     -]/[-   4:14
     -( )-   4:14
B17/0
     -] [-   2:0 2:1 2:2 2:3 2:4 2:5 3:10 4:12 4:13 4:15 4:16
     -]/[-   2:6 2:7 3:10 4:12 4:13 4:15 4:16
I:013/01
     -] [-   4:15
     -]/[-   4:16
I:013/06
     -] [-   4:15
```

```
I:013/06
     -]/[-   4:16
Rung 4:17
Turns on discrete write clear bit to return scale to gross mode
|   B3                        I:013                                    O:013  |
+--] [-------------------------+-] [-------------------------------------( )-+-+
|     8                       |   15                                     04| |
|                             |+GEQ--------------------+ +COP-------------+| |
|                             ++GREATER THAN OR EQUAL  +-+COPY FILE         ++ |
|                              |Source A          F8:12| |Source     #N16:20| |
|                              |                1.000000| |Destination  #N9:0| |
|                              |Source B          F18:1| |Length            9| |
|                              |                10.00000| +------------------+ |
|                              +------------------------+                      |
B3/8
     -] [-   2:11 2:12 2:13 3:10 3:11 3:12 4:16 4:17 4:18
     -]/[-   2:13 3:4 3:8 4:7 4:12 4:13 4:15
     -( )-   3:10 4:16
F8:12
     -CPT-   2:1 2:2 2:4 2:5 2:6 2:7
     -EQU-   3:2 3:7 4:4
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4 4:14
     -LEQ-   3:3 3:12 4:5 4:14 4:18
     -NEQ-   3:3 4:5
F18:1
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4
     -LEQ-   3:3 3:12 4:5 4:18
I:013/15
     -] [-   4:7 4:17
N9:0
     -BTW-   4:1
     -COP-   4:12 4:15 4:17
     -MOV-   4:19
N16:20
     -COP-   4:17
O:013/04
     -( )-   4:17
Rung 4:18
Feed sequence complete when feed is done and weight is removed
|   B3  +LEQ---------------+                                              C5:0  |
+--] [--+LESS THAN OR EQUAL+----------------------------------------------+(RES)+-+
|     8 |Source A     F8:12|                                              |     | |
|       |                  |                                              |  B3 | |
|       |Source B     F18:1|                                             +-( )-+ |
|       |                  |                                                4  |
|       +------------------+                                                   |
B3/4
     -] [-   3:13 4:19
     -]/[-   3:1 3:2 3:5 4:3 4:4 4:7 4:13 4:16
     -( )-   3:12 4:18
B3/8
     -] [-   2:11 2:12 2:13 3:10 3:11 3:12 4:16 4:17 4:18
     -]/[-   2:13 3:4 3:8 4:7 4:12 4:13 4:15
```

```
B3/8
     -( )-   3:10 4:16
C5:0
     -CTU-   2:10
     -RES-   3:12 4:18
C5:0.ACC
     -EQU-   2:11 2:11 2:12 2:12
C5:0.DN
     -]/[-   2:10
F8:12
     -CPT-   2:1 2:2 2:4 2:5 2:6 2:7
     -EQU-   3:2 3:7 4:4
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4 4:14
     -LEQ-   3:3 3:12 4:5 4:14 4:18
     -NEQ-   3:3 4:5
F18:1
     -GEQ-   2:11 2:13 4:17
     -GRT-   3:2 4:4
     -LEQ-   3:3 3:12 4:5 4:18
Rung 4:19
Turns on PAR 2.3 bit to indicate cycle complete
|    B3                                                                  O:013   |
+-+-] [-------+-------------------------------------------+----------------( )-+-+
| |     4     |                                           |                  16| |
| |O:013   B3 |                                           |+MOV---------------+| |
| +-] [---]/[-+                                           ++MOVE                ++ |
|     16     3                                            |Source            0|  |
|                                                         |                     |  |
|                                                         |Destination   N9:0|  |
|                                                         |                   0|  |
|                                                         +------------------+  |
B3/3
     -] [-   3:1 3:2 3:3 3:4 3:6 3:7 3:10 4:3 4:4 4:5 4:6 4:11
     -]/[-   3:13 4:19
     -( )-   3:1 4:3
B3/4
     -] [-   3:13 4:19
     -]/[-   3:1 3:2 3:5 4:3 4:4 4:7 4:13 4:16
     -( )-   3:12 4:18
N9:0
     -BTW-   4:1
     -COP-   4:12 4:15 4:17
     -MOV-   4:19
O:013/16
     -] [-   4:19
     -( )-   4:19
Rung 4:20
|                                                         +RET---------------+ |
+---------------------------------------------------------+RETURN ()          +-+
|                                                         |Return parameter  | |
|                                                         +------------------+ |

Rung 4:21
|                                                                              |
+-------------------------------[END OF FILE]-------------------------------+
|                                                                              |
NO I/O STATUS REPORT FOR THIS PROCESSOR
PROCESSOR STATUS REPORT CONTAINS THIS INFORMATION
```

```
Data Table Report          PLC-5/30          File TEST2            Data Table File F8:0
  Address      0                1                2                3                4
F8:0         1000.000         5O.OOOOO         500.0000         5.000000         0.000000
F8:5         0.000000         0.000000         0.000000         0.000000         0.000000
F8:10        0.000000         0.000000         1.000000     1.048575e+06         0.000000
F8:15        0.000000         0.000000         0.000000         0.000000

Address         0       1       2       3       4       5       6       7       8       9
N9:0       \00\00  R    e   m   o   v   e       W   e    i   g    h    t
N9:10           s  p    2   0   6   @   á  \00\00   \00\00   \00\00  \00\00  \00\00  \00\00
N9:20      \00\00  \00\00  \00\00  \00\00  \00\00   \00\00   \00\00  \00\00  \00\00  \00\00
N9:30      \00\00  \00\00  \00\00  \00\00  \00\00   \00\00   \00\00  \00\00  \00\00
N9:40           w  t    1  1    0               w   t    1   0    1  \00\00  \00\00  \00\00
N9:50      \80\80  \00  @  \00\00  \00\00  \00  @   \00\00   \00\00  \00\00  \00\00  \00\00
N9:60      \00\00  \00\00  \00\00  \00\00


Press a function key or enter a value.
N9:0 = ζ
Rem Prog    Forces:None       Data:ASCII        Addr:Decimal      5/30 File Test2
Change                          Specify            Next           Prev
 Radix                          Address            File           File
   F1                             F5                F7             F8

Address         0       1       2       3       4       5       6       7       8       9
N10:0                   w   t   1   1   0  ?    Ç   \00\00               w  t   1    0   1
N10:10                                             1   \00\00  \00\00  \00\00  \00\00  \00\00
N10:20     \00\00  \00\00  \00\00  \00\00  \00\00   \00\00   \00\00  \00\00  \00\00  \00\00
N10:30     \FF\FF  \FF\DF  \FF B   \FF\FF  \00\00   \00\00   \00\00  \00\00  \00\00  \00\00
N10:40     \00\00  \00\00  \00\00  \00\00  \00\00   \00\00   \00\00  \00\00  \00\00  \00\00
N10:50     \00\00  \00\00  \00\00  \00\00  \00\00   \00\00   \00\00  \00\00  \00\00  \00\00
N10:60     \00\00  \00\00  \00\00  \00\00


Press a function key or enter a value.
N10:0 = ζ
Rem Prog    Forces:None       Data:ASCII      Addr:Decimal        5/30 File TEST2
Change                          Specify           Next            Prev
 Radix                          Address           File            File
  F1                              F5               F7              F8


Data Table Report     PLC-5/30          File TEST2             Data Table File N11:0
  Address      0       1       2       3       4      5       6      7      8      9
N11:0         8208     64      47       9       0      0       0      0      0      0
N11:10      -24432     64       0      10       0      0       0      0      0      0
N11:20        250      0       0       0       0      0       0      0      0      0
N11:30       1250      0       0       0       0      0       0      0      0      0
N11:40          0      0       0       0       0      0       0      0      0      0


Data Table Report     PLC-5/30          File TEST2             Data Table File N12:0
  Address      0       1       2       3       4      5       6      7      8      9
N12:0         8224    8307   28721   12341       0      0       0      0      0      0
N12:10        8224    8307   28721   12342       0      0       0      0      0      0
N12:20        8224    8307   28722   12341       0      0       0      0      0      0
N12:30        8224    8307   28722   12342       0      0       0      0      0      0
N12:40          0       0       0       0       0      0       0      0      0      0
```

PLC-5 Extended Data Program Example



Discrete Data Formats

Discrete Read (Jaguar output to PLC input)

A/B Addr	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0
Word 0 In	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Word 1 In	Data OK	Update	NET	MOT	PAR 1.3	PAR 1.2	PAR 1.1	ESC	SP8	SP7	SP6	SP5	SP4	SP3	SP2	SP1

Discrete Write (PLC output to Jaguar input)

A/B Addr	17	16	15	14	13	12	11	10	7	6	5	4	3	2	1	0
Word 0 Out	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Word 1 Out	Load SP1	PAR 2.3	PAR 2.2	PAR 2.1	Displ 3	Displ 2	Displ 1	Enab l SP	ZERO	PRNT	TARE	CLR	Load Tare	SEL 3	SEL 2	SEL 1

Discrete Read Word 0 is a sixteen-bit signed integer that represents the weight or rate value of the scale. The three SEL bits of Discrete Write Word 1 determine whether it is gross, net, tare, or displayed weight, SP1 or rate. Discrete Write Word 0 is a sixteen-bit signed integer whose value can be loaded into tare or SP1 depending on the Load SP1 or Load Tare bits in Discrete Write Word 1.

SEL 1-3 represent a binary value to select the data for Discrete Read Word 0.
0= gross weight, 1 = net weight, 2 = displayed weight, 3 = tare weight, 4 = SP1 5 = rate

Displ 1-3 determine what data is in the lower display of the Jaguar.
0 = normal display mode, 1 = display Lit01, 2 = display Lit02, 3 = display Lit03, 4 = display Lit04,
5 = display Lit05, 6 = reserved, 7 = display from block transfer input

Block Transfer Formats

Block Transfer Write (Words 0 - 63) to Jaguar

Base #	0	1	2	3	4	5	6	7	8	9
N#:0	Display Mode *	16 Byte Display String: sent from PLC to Jaguar to be displayed if preceding word is non-zero value and discrete display bits are set to 7								8 Byte>> ASCII
N#:10	<<Floating Point Write Field Code: shows where next value will be loaded			Floating Point Write Value		8 Byte ASCII String Write Field Code: shows where the next value will be loaded				40 Byte>>
N#:20	<<40 Byte String Data >>									
N#:30	<< 40 Byte String Data: note if string is shorter than 40 bytes it must be left justified and null-terminated									8 Byte>> ASCII
N#:40	<<Floating Point Read Field Code: requests FP value for BTR			8 Byte (ASCII) String Read Field Code: requests string value for BTR			Reserved			
N#:50	Reserved									
N#:60	Reserved									

Block Transfer Read (Words 0 - 63) from Jaguar

Base #	0	1	2	3	4	5	6	7	8	9
N#:0	8 Byte (ASCII) Floating Point Read Field Code: name of value sent in next field				Floating Point Read Value		8 Byte(ASCII) String Read Field Code: name of string sent in next field			
N#:10	40 Byte Data String>>									
N#:20	<< 40 Byte Data String: note if string is shorter than 40 bytes it must be left-justified (and null-terminated??)									
N#:30	Reserved									
N#:40	Reserved									
N#:50	Reserved									
N#:60	Reserved									

* Display Mode: the integer value of this word determines how the Jaguar lower display operates: 0 = reset display to normal mode, 1 = display until overwritten by PLC or ESC is pressed, 2 = display for 30 seconds, 3 = display for 60 seconds, any value > 3 = reserved.

All Field Codes must be five right-justified bytes expanded to eight with three leading spaces.
Example SD = wt101 .... Hex value of field code = 2020 2077 7431 3031

Addressing Examples:

1) A two Jaguar system with two scales per Jaguar is configured as rack 01. The BTR and BTW mode cannot be used since the full rack must be used for discretes. Scale 1A would write its outputs to **I:010.0 - I:011.17** of the PLC. Scale 1B would write its outputs to **I:012.0 - I:013.17** of the PLC. Scale 2A would write its outputs to **I:014.0 - I:015.17** of the PLC. Scale 2B would write its outputs to **I:016.0 - I:017.17** of the PLC. Each scale would read its inputs from a corresponding output address of the PLC. (Example: scale 1A and **O:010.0 - O:011.17**)

2) A two Jaguar system with two scales and an A/B RIO card per Jaguar. Jaguar #1 is configured as rack 01, Jaguar #2 is configured as rack 02. BTR and BTW are enabled. Each rack is configured as 3/4: the first quarter for block transfer, the second quarter for scale A, and the third quarter for scale B. Scale 1A would write its outputs to **I:012.0 - I:013.17** of the PLC. Scale 1B would write its outputs to **I:014.0 - I:015.17** of the PLC. Scale 2A would write its outputs to **I:022.0 - I:023.17** of the PLC. Scale 2B would write its outputs to **I:024.0 - I:025.17** of the PLC. Each scale would read its input from a corresponding output address of the PLC. (Example: scale 1A and **O:012.0 - O:013.17**)

3) BTW at N11:0, BTR at N11:64 > 8 byte FP write field code is at **N11:09 - N11:12**, 8 byte FP read field code request from BTW is at **N11:39 - N11:42**, 8 byte FP read field code in BTR is at **N11:64 - N11:67**, 8 byte string read field code in BTR is at **N11:70 - N11:73**.

2 PROFIBUS

Equipment installed in the field for the automation of technical processes such as sensors, actuators, transmitters, drives and programmable logic controllers, is increasingly using digital microelectronics. Bit serial Fieldbuses are being applied for the communication between these digital field devices and higher level automation components. Currently, a diversity of proprietary networks exists in the Fieldbus area. The use of these networks often results in isolated incompatible solutions.

The need for an open, vendor independent communication system led to the specification and standardization of PROFIBUS.

In any Fieldbus standard many definitions are necessary in order to describe the protocol completely and clearly. The result is a complex standard that seems to be difficult to understand at first sight. Any technical questions about the PROFIBUS Interface should be referred to the German national standard PROFIBUS, DIN 19 245. Information is also available through the PROFIBUS User Organization.

PROFIBUS Overview

This section describes the option that permits the Jaguar to communicate to a PROFIBUS L2-DP master according to DIN 19 245. The option consists of a Jaguar backplane-compatible module and software that resides in the Jaguar, which implements the data exchange.

The Jaguar PROFIBUS interfaces to PLC's such as, Texas Instruments 505 series, Siemens S5 series, and Siemens S7 series PLCs.

The Texas Instruments (TI) 505 PLCs interface to the PROFIBUS via an I/O processor called a Field Interface Module (FIM). The FIM bus master recognizes a fixed set of PROFIBUS slave devices, all of which are viewed by it as some sort of remote I/O rack. On power up, the FIM queries each PROFIBUS slave node to determine which of the recognized types a device might be and configures itself accordingly. The Jaguar PROFIBUS option appears to the FIM to be a small ET200U I/O rack.

The Siemens S5-115 series PLC also interfaces to the PROFIBUS using an I/O processor, an IM-308, which has no preconceived notions about PROFIBUS devices. This device must be locally programmed with the Jaguar interface Device Data Base (DDB).

Floating Point Numbers

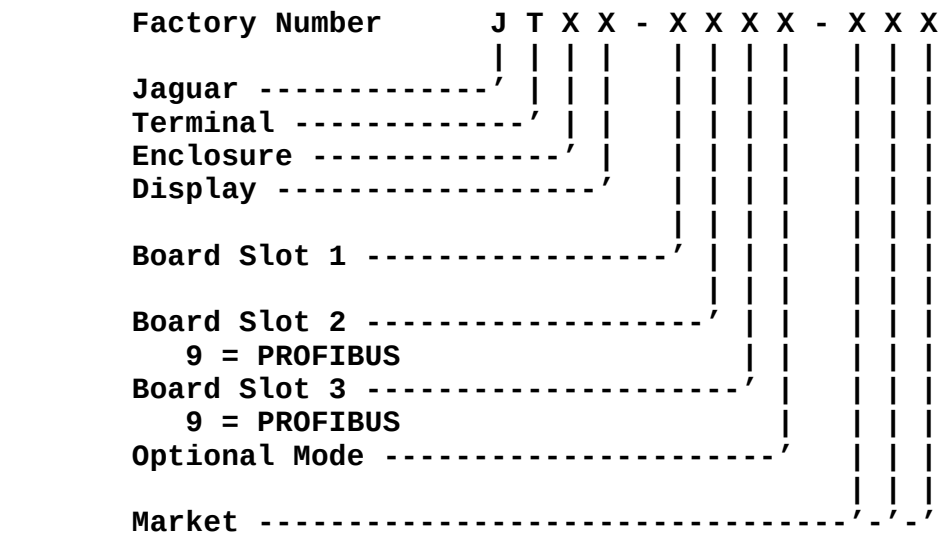
The Simatic TI505 PLC's support the IEEE Standard floating point numbers. According the Simatic TI505 Programming Reference Manual, page 2-5, real numbers are stored in the single-precision 32-bit format, according to ANSI/IEEE Standard 754-1985, in the range 5.42101070 E-20 to 9.22337177 E18.

Siemens S5 PLC's do not support inherently the IEEE-format floating point numbers. S5 PLC's do support floating point numbers in their own unique format. You can implement a software "function block" in the S5 PLC that converts between the S5 floating point numbers and the IEEE Standard floating point numbers. Appendix 2 shows a sample PLC program for converting a IEEE Standard Floating Point Number to an S5-format Floating Point Number.

The Siemens S7 PLC's support the IEEE Standard floating point numbers.

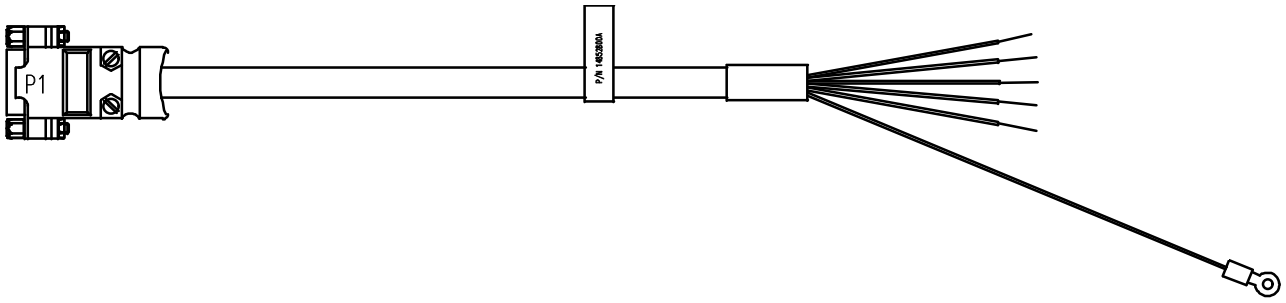
Factory Order Numbers

PROFIBUS is Jaguar Option PCB 9, configurable in either board option slot 2 or 3, and is also available as an add in kit of parts. The factory order number structure is shown below to order the PROFIBUS as an installed option in the Jaguar from the factory. Only one PLC interface option may be installed in a Jaguar Chassis.



The PROFIBUS PCB is also available as a field installed kit by ordering Factory Number 0917-0243.

When using the Jaguar Desk Mount or Harsh Environment, a Pigtail Adapter Harness is required in order to install the rear panel or front cover on the Jaguar. The Adapter harness can be ordered from the factory using factory number 0900-0311. The adapter is shown below.



14552800A PROFIBUS PIGTAIL ADAPTER FOR DESK MOUNT JAGUAR					
FROM		**TO**			
PT. 1	**END 1**	**PT. 2**	**END 2**	**COLOR**	**SIGNAL**
P1-4	10856700A	- - -	¼" STRIP	YELLOW	RTS
P1-8	10856700A	- - -	¼" STRIP	BLUE	COM A
P1-3	10856700A	- - -	¼" STRIP	GREEN	COM B
P1-6	10856700A	- - -	¼" STRIP	RED	+5V
P1-5	10856700A	- - -	¼" STRIP	BLACK	GND
1G	12471400A	DRAIN	SOLDER	GREEN	DRAIN

Communications

PROFIBUS is based on a variety of existing national and international standards. The protocol architecture is based on the Open Systems Interconnection (OSI) reference model in accordance with the international standard ISO 7498.

Jaguar supports the PROFIBUS-DP which is designed for high speed data transfer at the sensor actuator level. (DP means Distributed Peripherals.) At this level, controllers such as programmable logic controllers (PLCs) exchange data via a fast serial link with their distributed peripherals. The data exchange with these distributed devices is mainly cyclic. The central controller (master) reads the input information from the slaves and sends the output information back to the slaves. It is important that the bus cycle time is shorter than the program cycle time of the controller, which is approximately 10 ms in most applications. The following is a summary of the technical features of the PROFIBUS-DP communications protocol:

- **Transmission Technique**: PROFIBUS DIN 19 245 Part 1

  -EIA RS 485 twisted pair cable or fibre optic

  -9.6 kbit/s up to 12 Mbit/s, max distance 200 m at 1.5 Mbit/s extendible with repeaters

  -12 megabaud maximum rate

- **Medium Access**: hybrid medium access protocol according to DIN 19 245 Part 1

  - Mono-Master or Multi-Master systems supported

  - Master and Slave Devices, max 126 stations possible

- **Communications**: Peer-to-Peer (user data transfer) or Multicast (synchronization)

  - Cyclic Master-Slave user data transfer and acyclic Master-Master data transfer.

- **Operation Modes**:

  - Operate: cyclic transfer of input and output data

  - Clear: inputs are read and outputs are cleared

  - Stop: only master-master functions are possible

- **Synchronization**: enables synchronization of the inputs and/or outputs of all DP-Slaves (Not supported by Jaguar).

  - Sync-Mode: Outputs are synchronized

  - Freeze-Mode: Inputs are synchronized

- **Functionality**:
  - Cyclic user data transfer between DP-Master(s) and DP-Slave(s)
  - Activation or deactivation of individual DP-Slaves
  - Checking of the configuration of the DP-Slaves
  - Powerful diagnosis mechanisms, 3 hierarchical levels of the diagnosis
  - Synchronization of inputs and/or outputs
  - Address assignment for the DP-Slaves over the bus
  - Configuration of the DP-Master (DPM1) over the bus
  - Max. 246 byte input and output data per DP-Slave, typical 32 byte
- **Security and Protection mechanisms**:
  - All Messages are transmitted with Hamming Distance HD=4
  - Watch-Dog Timer at the DP-Slaves
  - Access protection for the inputs/outputs at the DP-Slaves
  - Data transfer monitoring with configurable timer interval at the DP-Master (DPM1)
- **Device-Types**:
  - DP-Master Class 2 (DPM2) e.g. programming/configuration device
  - DP-Master Class 1 (DPM1) e.g. central controller like PLC, CNC, RC ...
  - DP-Slave e.g. Input/Output device with binary or analogue inputs/outputs, drives . (Jaguar)
- **Cabling and Installation**:
  - Coupling or uncoupling of stations without affection of other stations
  - Proven and easy to handle two conductor transmission technique

Data Definition

The PROFIBUS network supports **Discrete Data Transfer** that allows for bi-directional communication of discrete bit encoded information or 16 bit binary word (signed integer) numerical values.

- Floating Point Transfer that allows bi-directional exchange of floating point data encoded in IEEE 754 single precision floating point format.
- Shared Data Transfer that allows PLC access to most Jaguar shared data fields.

Discrete Data

On PROFIBUS, there are two words (32 bits) of input data for each scale and two words of output data for each scale. The Jaguar supports up to four scales with a single PROFIBUS interface card. In a four scale configuration, at least two on the scales are in a remote Jaguar connected to the host Jaguar over an ARCnet LAN. The data in these input and output words is formatted as follows:

DISCRETE READ - JAGUAR Output to PLC Input		
Bit Numbers	**Word 0[1]**	**Word 1**
0	Signed 16 Bit Integer Weight Data	Setpoint 1
1		Setpoint 2
2		Setpoint 3
3		Setpoint 4
4		Setpoint 5
5		Setpoint 6
6		Setpoint 7
7		Setpoint 8
8		ESC Key[2]
9		PAR 1.1[3]
10		PAR 1.2[3]
11		PAR 1.3[3]
12		Motion[4]
13		Net Mode[5]
14		Update in Progress[6]
15		Data OK[7]

1. Word 0 is a sixteen-bit signed integer that may represent the scale gross, net, tare, rate, setpoint #1, or displayed weight. Three bits, set by the PLC, designate data sent by the Jaguar.
2. Bit 8 is set to a 1 when the ESCAPE key is pressed on the keypad of the Jaguar where the RIO option is installed. The bit will be cleared to 0 when the display mode bits (see next table) change from 0 to a non-zero value.
3. Bits 9, 10, and 11 mirror the state of the first three input bits on the controller board of the Jaguar. These are labeled IN1, IN2, and IN3. If the input is ON (input grounded) then the bit is set to a 1.
4. Bit 12 is set to a 1 when the scale is unstable.
5. Bit 13 is set to a 1 when the scale is in the net mode.
6. When this flag is 1, the PLC scanner has read the data while the Jaguar is in the middle of updating the data. The PLC should ignore the data in this case and simply re-scan the data.
7. Bit 15 is set to a 1 when the scale is operating properly, not over or under capacity, and not in power up or expanded weight mode. The PLC program should continuously monitor this bit to determine the validity of the data.

DISCRETE WRITE - PLC Output to JAGUAR Input		
Bit Numbers	**Word 0**	**Word 1**
0	Signed 16 Bit Integer Tare	Select 1[1]
1		Select 2[1]
2		Select 3[1]
3		Load Preset Tare[10]
4		Clear Command[2]
5		Tare Command[3]
6		Print Command[4]
7		Zero Command[5]
8		Disable Setpoint[6]
9		Display Mode[8]
10		Display Mode[8]
11		Display Mode[8]
12		PAR 2.1[9]
13		PAR 2.2[9]
14		PAR 2.3[9]
15		Load SP-1 Value[7]

1. A binary value in bits 0-2 select the data in Discrete Read WORD 0. 0 = gross weight, 1 = net weight, 2 = displayed weight, 3 = tare weight, 4 = setpoint 1, 5 = rate. Values greater than five are gross weight.
2. A transition from 0 to 1 causes a “clear” (return to gross) command.
3. A transition from 0 to 1 causes a “automatic tare” command.
4. A transition from 0 to 1 causes a “print” command.
5. A transition from 0 to 1 causes a “zero” command.
6. Set Bit 8 to 0 to disable the setpoint outputs. Set Bit 8 to 1 to enable the setpoint outputs.
7. A transition from 0 to 1 loads the value in WORD 0 into setpoint 1 value in Jaguar.
8. Bits 9, 10, and 11 determine how the data is displayed in the lower display area. 0 = normal display mode, 1 = display literal 1, 2 = display literal 2, 3 = display literal 3, 4 = display literal 4, 5 = display literal 5, 6 = reserved, 7 = display from block transfer input. Pressing ESCAPE also clears the display to normal mode. Display literals may be pre-programmed in Jaguar setup through the Configure Memory program block. Literals may also be sent to Jaguar from the PLC (lit01, lit02, lit03, lit04, or lit05).
9. Bits 12, 13, and 14 control the state of the first three output bits on the controller board of the Jaguar where the PLC option card is installed. These are labeled OUT1, OUT2, and OUT3. A 1 causes the output to be turned ON.
10. A transition from 0 to 1 loads the value in WORD 0 into the preset tare register.

Extended Weight Discrete Read Format

The Jaguar operating system has been extended to optionally provide 21-bits of weight information for Discrete Read by the PLC. The extended data format is applicable to both rate and weight information.

The Extended-Weight Discrete Read format can be enabled through the following menu selections:

Config Options
PROFIBUS
Scale Setup
Data Format? Ext

The lower 16 bits of the weight are in Word 0 of the Discrete Read data as before. The upper 5 bits of the weight information are now in bits 0 to 4 of Word 1 of the Discrete Read data.

The setpoint coincidence flags for setpoints 1, 2, and 3 are now in bits 5, 6, and 7 of Word 1 of the Discrete Read data. Setpoints 4 through 8 have been eliminated in the Extended-Weight Discrete Read data to make room for the extended weight information.

Bit 14 of the Word 1 of the Discrete Read data is an “update-in-progress” flag. When this flag is 1, the PLC scanner has read the data while the Jaguar is in the middle of updating the data. The PLC should ignore the data in this case and simply re-scan the data.

Extended Weight Discrete Read Output to PLC Input		
Bit Numbers	**Word 0[1]**	**Word 1**
0	Lower 16 Bits Integer Weight Data (Upper 5 bits of weight are bits 0-4 of word 1.)	Weight 17
1		Weight 18
2		Weight 19
3		Weight 20
4		Weight 21 (sign bit)
5		Setpoint 1
6		Setpoint 2
7		Setpoint 3
8		ESC Key[2]
9		PAR 1.1[3]
10		PAR 1.2[3]
11		PAR 1.3[3]
12		Motion[4]
13		Net Mode[5]
14		Update In Progress[6]
15		Data OK[7]

1. Word 0 and 1 is a 21-bit signed integer that may represent the scale gross, net, tare or displayed weight. Three bits, set by the PLC, designate data sent by the Jaguar.
2. Bit 8 is set to a 1 when the ESCAPE key is pressed on the keypad of the Jaguar where the RIO option is installed. The bit will be cleared to 0 when the display mode bits (see next table) change from 0 to a non-zero value.
3. Bits 9, 10, and 11 mirror the state of the first three input bits on the controller board of the Jaguar. These are labeled IN1, IN2, and IN3. If the input is ON (input grounded) then the bit is set to a 1.
4. Bit 12 is set to a 1 when the scale is unstable.
5. Bit 13 is set to a 1 when the scale is in the net mode.
6. When this flag is 1, the PLC scanner has read the data while the Jaguar is in the middle of updating the data. The PLC should ignore the data in this case and simply re-scan the data.
7. Bit 15 is set to a 1 when the scale is operating properly, not over or under capacity, and not in power up or expanded weight mode. The PLC program should continuously monitor this bit and the PLC processor “rack fault” bit (see PLC documentation) to determine the validity of the discrete and block transfer data.

Shared Data

PROFIBUS PLC's can access Shared Data. Since the PROFIBUS communications supports up to 244-byte messages at speeds typically in the range of 1.5 to 12 megahertz, there is not a need for two separate modes of communications. PROFIBUS PLC's can set and retrieve Jaguar “Shared Data” variables, and can write operator lead-through messages on the lower Jaguar display. For PROFIBUS, the PLC Output Message has additional fields for accessing Shared Data. The PLC must specify the Shared Data command and variable name in the PLC Output Message. If the command is a write command, then the PLC Output Message must also contain the write data field. Its maximum length is 20 bytes. Similarly, when the shared data command is a read command, the PLC Input Message has a read field containing the data read from Shared Data. Its maximum length is 20 bytes. The Shared Data variables are self-typing; that is, the Jaguar determines the type of any valid data field in the message from the variable’s name and definition in Shared Data.

In weight-synchronous mode, PROFIBUS PLC's can set and retrieve Jaguar “Shared Data” variables, and can write operator lead-through messages on the lower Jaguar display. The PLC Output Message has additional fields for accessing Shared Data. The PLC must specify the Shared Data command and variable name in the PLC Output Message. If the command is a write command, then the PLC Output Message must also contain the write data field. Its maximum length is 20 bytes. Similarly, when the shared data command is a read command, the PLC Input Message has a read field containing the data read from Shared Data. Its maximum length is 20 bytes. The Shared Data variables are “self-typing”; that is, the Jaguar determines the type of any valid data field in the message from the variable’s name and definition in Shared Data.

Integer Input Message

The Jaguar uses this message format to send integer weight and scale status to the PROFIBUS PLC. The Jaguar uses bytes 18-39 to report the status of the Shared Data access and to return Shared Data values the PLC has requested.

Byte 0-1	Scale 1 Integer Weight
Byte 2-3	Scale 1 Status
Byte 4-5	Scale 2 Integer Weight
Byte 6-7	Scale 2 Status
Byte 8-9	Scale 3 Integer Weight
Byte 10-11	Scale 3 Status
Byte 12-13	Scale 4 Integer Weight
Byte 14-15	Scale 4 Status
Byte 18-19	Shared Data Access Status
Byte 20-39	Shared Data Read Field Value

Integer Output Message

The PROFIBUS PLC uses these message formats to send "bit-oriented" commands and associated integer values to the Jaguar. The discrete data section describes the formats for bytes 0-15 of these messages. The PROFIBUS PLC uses bytes 16-45 to request access of data in Jaguar Shared Data.

Byte 0-1	Scale 1 Integer Tare or Setpoint Value
Byte 2-3	Scale 1 Bit-Oriented Commands
Byte 4-5	Scale 2 Integer Tare or Setpoint Value
Byte 6-7	Scale 2 Bit-Oriented Command
Byte 8-9	Scale 3 Integer Tare or Setpoint Value
Byte 10-11	Scale 3 Bit-Oriented Command
Byte 12-13	Scale 4 Integer Tare or Setpoint Value
Byte 14-15	Scale 4 Bit-Oriented Command
Byte 16-17	Shared Data Command
Byte 18-19	Shared Data Field Name - Remote Jaguar Name
Byte 20-25	Shared Data Field Name - Variable Name
Byte 26-45	Shared Data Write Value

Floating Point Data Transfer

The Jaguar can communicate weight to the PLC in a floating point weight format with integer commands. The Jaguar must set up in the "floating point" weight mode.

The PLC issues a command for a particular scale by setting a Scale Command in the PLC Output Message. Each Command is a two-byte integer, and there is a separate Command for each scale. The Jaguar recognizes a new command from the PLC when it sees a new value in the Scale Command register. If the Command has an associated floating point value, the PLC must set the value in the floating point output register before issuing the Command.

The Jaguar acknowledges each non-Null command from the PLC. After processing a command for a particular scale, the Jaguar sets a new value in the Command Acknowledge bits for the scale in the PLC Input Message. The PLC must wait for the command acknowledgment before issuing a new command.

The PLC can select a rotation of up to nine floating point, real-time input fields from each scale. Real-time fields are the weight and rate fields. For example, the PLC can alternatively look at weight and rate by issuing commands to place both in the rotation. The Jaguar stores the rotation in Shared Data so that the rotation does not have to be reinitialized after each power cycle. When the PLC does not set up an input rotation, the default input rotation consists of gross weight only

The PLC may request that the Jaguar continually cycle among the fields of the input rotation by setting command 0. Then the Jaguar will automatically select the next field from the input rotation at the next A-to-D update. For example, the A-to-D update rate for an Analog Scale is 17 hertz when the Application

Type is set to Process Application. Then, the PLC application must be ready to process the next input field in 58 milliseconds.

To control the pace of the input rotation, PLC may request the next field from the input rotation by alternating between commands 1 and 2. The PLC needs to change the command value so that the Jaguar knows when the PLC is requesting a new field. Then, the PLC controls when the Jaguar switches to the next field of input rotation.

Commands 10 through 29 are “Report Data” commands. As long as one of the Report Data commands is in the Scale Command, the Jaguar will report the requested data and will not report data from the input rotation.

When the PLC requests a real-time field from the Jaguar, the Jaguar acknowledges the command only once but sends a new value for that field at every analog-to-digital weight update. The PLC requests real-time fields either through the report data command or through the input rotation.

When the PLC requests a static field from the Jaguar, the Jaguar acknowledges the command once and sets a new value for that field in the output register once. However, that value remains in the output register until the PLC issues another command. Examples of static fields are setpoint and filter values.

After acknowledging the previous command, the Jaguar will act on a new command only when the PLC sets a new value in a Scale Command in the PLC Output message.

In weight-synchronous mode, PROFIBUS PLCs can set and retrieve Jaguar “Shared Data” variables and can write operator lead-through messages on the lower Jaguar display. The PLC Output Message has additional fields for accessing Shared Data. The PLC must specify the Shared Data command and variable name in the PLC Output Message. If the command is a write command then the PLC Output Message must also contain the write data field. Its maximum length is 20 bytes. Similarly, when the shared data command is a read command, the PLC Input Message has a read field containing the data read from Shared Data. Its maximum length is 20 bytes. The Shared Data variables are “self-typing”; that is, the Jaguar determines the type of any valid data field in the message from the variable’s name and definition in Shared Data.

PLC Output Command Format

Four slots are available for PROFIBUS PLCs. Typically, the user assigns one slot per scale in the Jaguar "Config Options" menu. However, the user can increase the bandwidth of the I/O channel for one or two scales by selecting only one or two scales in the "Config Options" menu. The Jaguar uses the following criteria for assigning scale slots to scales:

- If the user selects one scale in the "Config Options" menu, then the Jaguar assigns slots 1 and 2 for communicating the scale data with the PLC.
- If the user selects two scales in a PROFIBUS configuration, then the Jaguar assigns slots 1 and 3 for communicating scale 1 data with the PLC; and it assigns slots 2 and 4 for communicating scale 2 data with the PLC.
- If the user selects more than two scales in a PROFIBUS configuration, then the Jaguar assigns one scale per scale slot.

Byte 0-1	Reserved
Byte 2-3	Scale Slot 1 Command
Byte 4-7	Scale Slot 1 Single-Precision Floating Point Value
Byte 8-9	Scale Slot 2 Command
Byte 10-13	Scale Slot 2 Single-Precision Floating Point Value
Byte 14-15	Scale Slot 3 Command
Byte 16-19	Scale Slot 3 Single-Precision Floating Point Value
Byte 20-21	Scale Slot 4 Command
Byte 22-25	Scale Slot 4 Single-Precision Floating Point Value
Byte 26-27	Shared Data Command
Byte 28-29	Shared Data Field Name - Remote Jaguar Name
Byte 30-35	Shared Data Field Name - Variable Name
Byte 36-55	Shared Data Write Value

PLC Output Scale Commands

Dec	Hex	Command
0	00	Report next field from input rotation at next A/D update [7]
1	01	Report next field from input rotation [6, 7]
2	02	Report next field from input rotation [6, 7]
3	03	Reset Input Rotation
10	0a	Report Gross Weight [2, 7]
11	0b	Report Net Weight [2, 7]
12	0c	Report Tare Weight [2, 7]
13	0d	Report Fine Gross Weight [2, 7]
14	0e	Report Fine Net Weight [2. 7]
15	0f	Report Fine Tare Weight [2, 7]
16	10	Report Rate [2, 7]
17	11	Report JagBASIC Custom Input 1 to PLC [2, 7]
18	12	Report JagBASIC Custom Input 2 to PLC [2, 7]
19	13	Report Low-Pass Filter Corner Frequency [2]
20	14	Report Notch Filter Frequency [2]
21	15	Report Setpoint 1 Coincidence Value [2, 4]
22	16	Report Setpoint 2 Coincidence Value [2, 4]
23	17	Report Setpoint 1 Dribble Value [2, 4]
24	18	Report Setpoint 2 Dribble Value [2, 4]
25	19	Report Setpoint 1 Tolerance Value [2, 4]
27	1b	Report JagBASIC Custom Input 3 to PLC [2]

28	1c	Report JagBASIC Custom Input 4 to PLC [2]
29	1d	Report Error After Error Indication [2]
30	1e	Report Primary Units - Low Increment Size [2]
40	28	Add Gross Weight to Input Rotation
41	29	Add Net Weight to Input Rotation
42	2a	Add Tare Weight to Input Rotation
43	2b	Add Fine Gross Weight to Input Rotation
44	2c	Add Fine Net Weight to Input Rotation
45	2d	Add Fine Tare Weight to Input Rotation
46	2e	Add Rate to Input Rotation
47	2f	Add JagBASIC Custom Input 1 to PLC to Input Rotation
48	30	Add JagBASIC Custom Input 2 to PLC to Input Rotation
60	3c	Set Programmable Tare [3]
61	3d	Set Push-Button Tare
62	3e	Clear Command
63	3f	Print Command
64	40	Zero Command
65	41	Select Scale A
66	42	Select Scale B
67	43	Select Other Scale
68	44	Custom Print 1 Command
69	45	Custom Print 2 Command
70	46	Custom Print 3 Command
71	47	Custom Print 4 Command
72	48	Custom Print 5 Command
73	49	Set Low-Pass Filter Corner Frequency [3]
74	4a	Set Notch Filter Frequency [3]
75	4b	Reset Escape Key
78	4e	Disable Error Display
79	4f	Enable Error Display
80	50	Set Normal Display Mode
81	51	Display Literal 1
82	52	Display Literal 2
83	53	Display Literal 3
84	54	Display Literal 4
85	55	Display Literal 5
87	57	Display Literal in Shared Data Block of Message
88	58	Disable Numeric Display
89	59	Enable Numeric Display
90	5a	Set Discrete Output 1 = ON
91	5b	Set Discrete Output 2 = ON
92	5c	Set Discrete Output 3 = ON
93	5d	Set Discrete Output 4 = ON
100	64	Set Discrete Output 1 = OFF
101	65	Set Discrete Output 2 = OFF
102	66	Set Discrete Output 3 = OFF
103	67	Set Discrete Output 4 = OFF
110	6e	Set Setpoint 1 Coincidence Value [3, 4]
111	6f	Set Setpoint 1 Dribble Value [3, 4]
112	70	Set Setpoint 1 Tolerance Value [3, 4]
114	72	Setpoint 1 = Enabled [4]
115	73	Setpoint 1 = Disabled [4]
116	74	Setpoint 1 = Gross Weight [4]
117	75	Setpoint 1 = Net Weight [4]
118	76	Setpoint 1 = Rate [4]

119	77	Setpoint 1 = Filling [4]
120	78	Setpoint 1 = Discharging [4]
121	79	Setpoint 1 = Latching Enabled [4]
122	7a	Setpoint 1 = Latching Disabled [4]
123	7b	Setpoint 1 = Reset Latch [4]
130	82	Set Setpoint 2 Coincidence Value [3, 4]
131	83	Set Setpoint 2 Dribble Value [3, 4]
134	86	Setpoint 2 = Enabled [4]
135	87	Setpoint 2 = Disabled [4]
136	88	Setpoint 2 = Gross Weight [4]
137	89	Setpoint 2 = Net Weight [4]
138	8a	Setpoint 2 = Rate [4]
139	8b	Setpoint 2 = Filling [4]
140	8c	Setpoint 2 = Discharging [4]
141	8d	Setpoint 2 = Latching Enabled [4]
142	8e	Setpoint 2 = Latching Disabled [4]
143	8f	Setpoint 2 = Reset Latch [4]
150	96	Set JagBASIC Custom Output 1 From PLC [5]
151	97	Set JagBASIC Custom Output 2 From PLC [5]
152	98	Set JagBASIC Custom Output 3 From PLC [5]
153	99	Set JagBASIC Custom Output 4 From PLC [5]
160	a0	Apply Scale Setup
161	a1	Write Scale Calibration to EEPROM
162	a2	Disable Tare from Control Panel
163	a3	Enable Tare from Control Panel

Notes:

2. A command requiring the Jaguar to report a specific value in the PLC input message. As long as one of these commands is in the Scale Command, the Jaguar will respond with the requested data and not with data from the input rotation.
3. A command requiring a floating point value output from the PLC to the Jaguar. The Jaguar reflects back the floating point value in the floating point register of input message to the PLC.
4. Indicates that the setpoint numbers are relative to each scale in the Jaguar. Scale A uses Setpoints 1 and 2. Scale B uses Setpoints 3 and 4.
5. A command in which a JagBASIC Application and the PLC define the format of the data which has a length of four bytes.
6. A command used by the PLC to select the next field from the input rotation. The PLC must alternate between these two commands to tell the Jaguar when to switch to the next field of the input rotation.
7. A command that requests real-time fields from the Jaguar. The Jaguar updates the input register to the PLC at the A/D update rate of scale.

PLC Output Message Shared Data Command

The PLC Output Message Shared Data Command is an integer field that initiates Shared Data access operations at the Jaguar.

The Jaguar processes a Shared Data commands “on demand” by the PLC. The Jaguar processes a new Shared Data command when the PLC puts a new value in the “Shared Data Command” field. The Jaguar does not provide “real time” Shared Data access where the Jaguar automatically sends new values to the PLC. The PLC must request each new access by setting a new value in the command field. To do successive reads, for example, the PLC must set alternately set a “null command” and a “read command” in the command field. For most efficient processing, the PLC should set a “null command” in the command field while it is setting the Jaguar name, variable name, and value in the output message. Once these variables are properly set up, the PLC should then set the command field to a “read command” or “write command”.

The Shared Data Command can have the following values:

0	Null Command
1	Read Shared Data
2	Write Shared Data
3	Write Jaguar Lower Display

Before sending a Shared Data Command to write to the Jaguar Lower Display, the PLC must issue command 57 in the Scale Commands to put the Jaguar in the mode of writing messages from the PLC Shared Data to the Lower Display.

PLC Input Message Format

The Allen-Bradley Remote I/O has two slots available.

Byte 0-1	Scale Slot 1 Command Response
Byte 2-5	Scale Slot 1 Single-Precision Floating Point Value
Byte 6-7	Scale Slot 1 Status
Byte 8-9	Scale Slot 2 Command Response
Byte 10-13	Scale Slot 2 Single-Precision Floating Point Value
Byte 14-15	Scale Slot 2 Status
Byte 16-17	Scale Slot 3 Command Response
Byte 18-21	Scale Slot 3 Single-Precision Floating Point Value
Byte 22-23	Scale Slot 3 Status
Byte 24-25	Scale Slot 4 Command Response
Byte 26-29	Scale Slot 4 Single-Precision Floating Point Value
Byte 30-31	Scale Slot 4 Status
Byte 32-33	Shared Data Access Status
Byte 34-53	Shared Data Read Field Value

Scale Input Status Format

The Jaguar sets the following status's in response to scale commands.

Command Response

Bits 0-7	Reserved
Bit 8	Floating Point Input Indicator
Bit 9	Floating Point Input Indicator
Bit 10	Floating Point Input Indicator
Bit 11	Floating Point Input Indicator
Bit 12	Floating Point Input Indicator
Bit 13	Data Integrity Bit 1[8]
Bit 14	Command Acknowledge 1
Bit 15	Command Acknowledge 2

Scale Status

Bit 0	Setpoint 1 Feeding
Bit 1	Setpoint 2 Feeding
Bit 2	Setpoint 1 Fast Feeding
Bit 3	Setpoint 2 Fast Feeding
Bit 4	Setpoint 1 In Tolerance
Bit 5	Scale Selected (weight on local Jaguar display)
Bit 6	JagBASIC Custom Bit 1
Bit 7	JagBASIC Custom Bit 2
Bit 8	Escape Keystroke
Bit 9	Discrete Input 1
Bit 10	Discrete Input 2
Bit 11	Discrete Input 3
Bit 12	Motion
Bit 13	Net
Bit 14	Data Integrity Bit 2[8]
Bit 15	Data OK/Error Indication

Note:

8. Data Integrity Bits required for Allen-Bradley PLC-5 Remote I/O Scanner. Both bits must have the same polarity for the data to be valid.

After processing a PLC Command, the Jaguar acknowledges it by setting a new value in the two Command Acknowledge bits. The Jaguar rotates sequentially among values 1, 2, 3, 1, 2, 3, 1, 2,... to acknowledge that it has recognized and processed a new, non-Null Command. When the PLC sees a new, non-zero value in the Command Acknowledge bits, it must verify the value is in sequence to confirm that the Jaguar has successfully completed the last command. The default value for the Command Acknowledge bits is 0.

The Floating Point Input Indicator bits tell the PLC what value is currently in Scale Single-Precision Floating Point Value. The PLC can set up a rotation of up to nine different fields by sending output commands to the Jaguar. Values 0, 1, 2, 3, 4, 5, 6, 7, and 8 represent floating point fields that may be part of the input rotation. The PLC can also issue a command to request that the Jaguar report a specific value. The Floating Point Input Indicator bits can have the following values:

0	Gross Weight [9]
1	Net Weight 9
2	Tare Weight 9
3	Fine Gross Weight [9]
4	Fine Net Weight [9]
5	Fine Tare Weight [9]
6	Rate [9]
7	JagBasic Custom Variable 1 [9]
8	JagBasic Custom Variable 2 [9]
9	JagBasic Custom Variable 3
10	JagBasic Custom Variable 4
11	Low-Pass Filter Corner Frequency
12	Notch Filter Frequency
13	Setpoint 1 Coincidence
14	Setpoint 2 Coincidence
15	Setpoint 1 Dribble
16	Setpoint 2 Dribble
17	Setpoint 1 Tolerance
18	Primary Units-Low Increment Size
19-28	Reserved
29	Last Jaguar Error Code
30	No Data Response - Command Successful
31	No Data Response - Command Failed

Note:

9. Real-time fields that the PLC may request either through the input rotation or through “report” commands. The PLC may request the other fields only from the “report” commands.

There are two custom status bits that a JagBASIC application can use to communicate special status’s to the PLC. Use them wisely. The JagBASIC application and PLC define the meaning of these bits.

The Data OK/Error indication bit reports scale over capacity, scale under zero, scale communication, and cluster communication off-line error conditions. When the PLC sees an error indication, it can send a command to the Jaguar to get the latest error status.

PLC Input Shared Data Status

The PLC Input Shared Data Status is an integer field that gives the status of the last Shared Data operation. The Jaguar supports this status for Profibus and Mobus Plus communications. It has the following values:

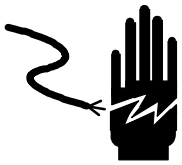
0	Null Status
1	Command Completed Successfully
2	Invalid Shared Data Name
3	Invalid Shared Data Command
4	Cannot Write Because This Is A Legal-For-Trade Field
5	Cannot Access Remote Jaguar

PROFIBUS Type Files

There are eight PROFIBUS type files for which the Jaguar supports different combinations of the integer weight, floating point weight, and shared data access. The length of the messages is different for each of the PROFIBUS types, but the length of the input and output messages are the same within each type. The Jaguar supports the following message types:

Length	Functionality
4	One Scales' Weight in Integer Mode.
8	Two Scales' Weight in Integer Mode.
12	Three Scales' Weight in Integer Mode.
16	Four Scales' Weight in Integer Mode, or One or Two Scales' Weight in Floating Point Mode.
24	Three Scales' Weight in Floating Point Mode.
32	Four Scales' Weight in Floating Point Mode.
46	Four Scales' Weight in Integer Mode with Shared Data Access.
56	Four Scales' Weight in Floating Point Mode with Shared Data Access.

PROFIBUS PCB Installation



WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

WARNING

DO NOT APPLY POWER TO THE JAGUAR UNTIL INSTALLATION OF COMPONENTS AND EXTERNAL WIRING HAVE BEEN COMPLETED.

To install the PROFIBUS PCB in the Jaguar:

- First disconnect power to the Jaguar by disconnecting the AC power cord from either the rear of the Jaguar, or at the AC outlet.
- Remove the Jaguar rear panel if installing in a GP (General Purpose) or HE (Harsh Environment) unit.
- Set the Jumpers on the PCB (Refer to Jumper Settings Section).
- Insert the PCB in slot 2 or 3 of the Jaguar.
- Tighten the two thumbscrews until the PCB is completely seated in the backplane connector.
- Connect the I/O wiring. If the GP/HE versions are used, install the Pigtail Adapter 0900-0311 in the rear panel cover and wire the adapter to the terminal strip as follows:

Color	Terminal Number	Signal
Yellow	1	RTS
Blue	2	COM A
Green	3	COM B
Red	4	+5VDC
Black	5	GND
Green	Chassis Gnd	

0900-0311 Adapter to Terminal Strip Wiring

- Reinstall the rear panel on the GP/HE versions.

- Connect the 9-Pin D subminiature L2-DP Bus connector (supplied by the PLC vendor) to the D subminiature connector on the PROFIBUS Option PCB (panel mount) or to the pigtail adapter.
- Reconnect AC power.
- Enter Setup and configure the PROFIBUS options (Refer to the Jaguar Setup For PROFIBUS Section).

Jaguar Setup for PROFIBUS

Jaguar automatically detects the presence of a PROFIBUS option board if one is installed, and adds the setup parameters to the options block. To configure the Jaguar for PROFIBUS, enter Setup and advance to the **CONFIG OPTIONS** sub-block. An example setup in the Jaguar is as follows:

Config Options

PROFIBUS

Scale Setup

Data Format?: Wgt, Div, Ext, or Flt

Number of Scales?: 1, 2, 3, or 4

Scale 2? Local

Scale 3? Remote

Node? Terminal 2

Internal Scale? A

Scale 4? Remote

Node? Terminal 2

Internal Scale? B

Node Communicate:

Rack Address? 005 (PROFIBUS node address).

(The Rack address is dependent on the address assigned by the programmer for the Jaguar)

Controlling Jaguar Discrete I/O using a PLC interface

Jaguar Terminal provides the ability to directly control its discrete outputs and read its discrete inputs via the (digital) PLC interface options. System integrators should be aware that Jaguar discrete I/O updates are synchronized with the Jaguar A/D rate, and not with the PLC I/O scan rate. This may cause a noticeable delay in reading inputs or in updating outputs as observed from the PLC to real world signals.

Siemens Simatic S5 Setup Example

The IM 308-C Hardware Interface Card in the Siemens S5 PLC supports the PROFIBUS Interface. The IM 308-C is configured with a FLASH card that is programmed on a PC.

COM ET 200 Software

Note: A copy of a self-extracting ZIP file named ME6713.EXE is available from the technical support BBS (614) 841-5169. This file is located in the Jaguar LIB and contains both Windows® and DOS® type files.

The COM ET 200 Program runs under PC Windows 3.1 to build the IM 308-C configuration and write it to the FLASH card. An example setup is as follows.

Jaguar Type File Example

Comment: JAGUAR

Order No.: blank for now

Station Type: JAGUAR

Manufacturer: METO

Family: JAGUAR

Periphery: JAGUAR

ASIC Type: SPC3

Manufacturer ID: 6713 (METO6713.GSD) This is in hex.

Min. Cycle: default

Programmable via bus: no

SYNC-able: No

FREEZE-able: No

Modular Station: No

Active Station: No

Even number of Slots: No

Baud Rates: Baud rates from 9.6K baud to 12 Mbaud, inclusively.

Slots

Max. number of inputs: 56 bytes
Max. number of outputs: 56 bytes
Max. address ID's: 16
Number of diagnostics: 7 bytes
Number of parameter: 7 bytes
predefined bytes: none
predefined IDs: none

Configuration File Sample

Bus Designation: PROFIBUS-DP

Bus Profile: PROFIBUS-DP
Baud: 12000 kBaud
Repeater on Bus: No
Parameters: Use Defaults

Host Designation: HOST System 1

Host Type: S5-115U/H / CPU942B
Reserve address areas for inputs
Start: P000
End: P027
Reserve address areas for outputs
Start: P000
End: P027
Power up delay: 20 seconds

Master Parameters

Station designation: Master System 1
Station type: IM 308-C
In host: Host System 1
Addressing: Linear
Number of IM 308-C: 0
Station number: 1
Multiprocessor mode: no
Defaults
Error Reporting Mode: QVZ
Response Monitoring for slaves: yes

Jaguar Station 1 Parameters

Family: Jaguar (from Jaguar type file)
Station Type: Jaguar (from Jaguar type file)
Parameters
Line 0
ID: 8A1
Type: Inputs
Length: 8
Format: Word
I Addr: P028
Line 1
ID: 8AO
Type: Outputs
Length: 8
Format: Word
O Addr: P028
Designation: none
Response Monitoring: yes
Error Reporting: QVZ
Station Number: 5

Jaguar Station 2 Parameters

Family: Jaguar (from Jaguar type file)
Station Type: Jaguar (from Jaguar type file)
Parameters
Line 0
ID: 8A1
Type: Inputs
Length: 8
Format: Word
I Addr: P044
Line 1
ID: 8AO
Type: Outputs
Length: 8
Format: Word
O Addr: P044
Response Monitoring: yes
Error Reporting: QVZ
Station Number: 6

TI545 Setup Example

The TI Series 505 PLC's use a hardware Field Interface Module (FIM) to implement the PROFIBUS-DP protocol. The FIM L2-DP allows the TI PLC's to interface to L2-DP I/O as though each slave were an I/O module in a remote base. After you configure the base and assign I/O address points to each slot, the I/O is automatically updated with the I/O from the slave. The FIM operates at baud rates from 9600 to 1.5 megabits per second.

Switch Settings

Refer to the SIMATIC TI505 Field Interface Module User Manual for the more complete setup details.

Setting Base Address

Switch 1 on the front panel of the FIM selects the desired base address. For example, set SW1 to 1 for base 1, 2 for base 2, etc.

Setting Baud Rate

Switch 2 on the front panel of the FIM selects the proper communications baud. For example, setting SW2 to 0 selects 1.5 megabits per second

Slave Address Range Selection

The S3-5, S3-6, and S3-7 switches on the FIM board are used for the slave address range selection. Each FIM can address 16 nodes out of the L2-DP maximum 126 nodes. These switches select a 16 node address range for the FIM. For example, when all three switches are in the Closed/On/0 position, the FIM module references slave addresses 17 through 32. In the configuration menus, slave addresses 17 through 32 then correspond to slots 1 through 16 for the particular base.

TISOFT 2 Software

TISOFT™ 2 software runs on a PC and configures the I/O addresses for slave devices connected to the FIM base over L2-DP. Refer to the SIMATIC TI505 TISOFT 2 User Manual. TISOFT communicates to the TI Series 505 PLC over a Serial RS232C communications link.

The FIM identifies and reports slaves in terms of I/O points. You must assign I/O addresses before the FIM will update them. When the slaves are configured properly, the assigned input points will immediately be updated with data from the slave, and the output points will be written to the slave.

Menu selections in TISOFT allow you to configure the I/O points (or addresses). At the main menu selection, select ONLINE or OFFLINE, then select CONFIO. Select the base, 1 through 16, corresponding to the base selected by Switch 1 on the FIM base. Then CONFIG the base. There are 16

TISOFT™ of Texas Instruments

slots within each base where each slot corresponds to a consecutive PROFIBUS node address.

For the Jaguar, all I/O addresses at the TI505 PLC are WORD I/O addresses. In TI terminology, these are WX addresses for input words and WY addresses for output words. Each Jaguar PROFIBUS node can support up to four scales - two local and two remote. Each scale requires two input words and two output words. Then, for example, to configure a Jaguar with four connected scales, you need to configure 8 WX's and 8 WY's in TISOFT for the FIM base.

TISOFT requires you to configure the beginning address, the number of WX's, and the number of WY's for each slot. For example, suppose we are configuring three Jaguars on a single PROFIBUS link with node addresses 17, 18, and 19. Each host Jaguar supports four scales - two local and two remote. Then, the following is a possible I/O address configuration mapping.

Slot	Address	# WX's	# WY's
1	0001	8	8
2	0017	8	8
3	0033	8	8

Once the I/O address table is configured, you need to run TISOFT in ONLINE mode to write the new configuration to the FIM base.

PROFIBUS PCB Wiring and Specifications

The PROFIBUS connection is available at two locations on the PROFIBUS PCB. The first is a female 9 pin D subminiature connector, which is the PROFIBUS standard connection. The field connector assembly is not supplied by Mettler Toledo. This connection is the preferred connection in Jaguar Panel Mount.

For Jaguar General Purpose and Harsh Environment the plugable terminal strip must be used, due to height restrictions above the rear of the card cage. In these cases, a pigtail harness is available to wire from the terminal strip to a female 9-pin D connector.

Processor: SP3 PROFIBUS ASIC

Memory: None

I/O: PROFIBUS network interface

Electrical: 1500V isolated RS422 type drivers

Connectors:

Female DE-9
1 GND (isolated)
2 N.C.
3 TX/RX+
4 RTS
5 GND (isolated)
6 +5V (isolated)
7 N.C.
8 TX/RX-
9 N.C.

Terminal strip
1 RTS
2 TXD/RXD+
3 TXD/RXD-
4 +5 V (isolated)
5 GND (isolated)

Bus Interface: Same as Connector PCB.

Power Requirements: +5 VDC

PCB Outline: 6.8” x 5.3”. 0.50” max height

PROFIBUS PCB Jumper Settings

W1 Install to share an IRQ. (default = installed).

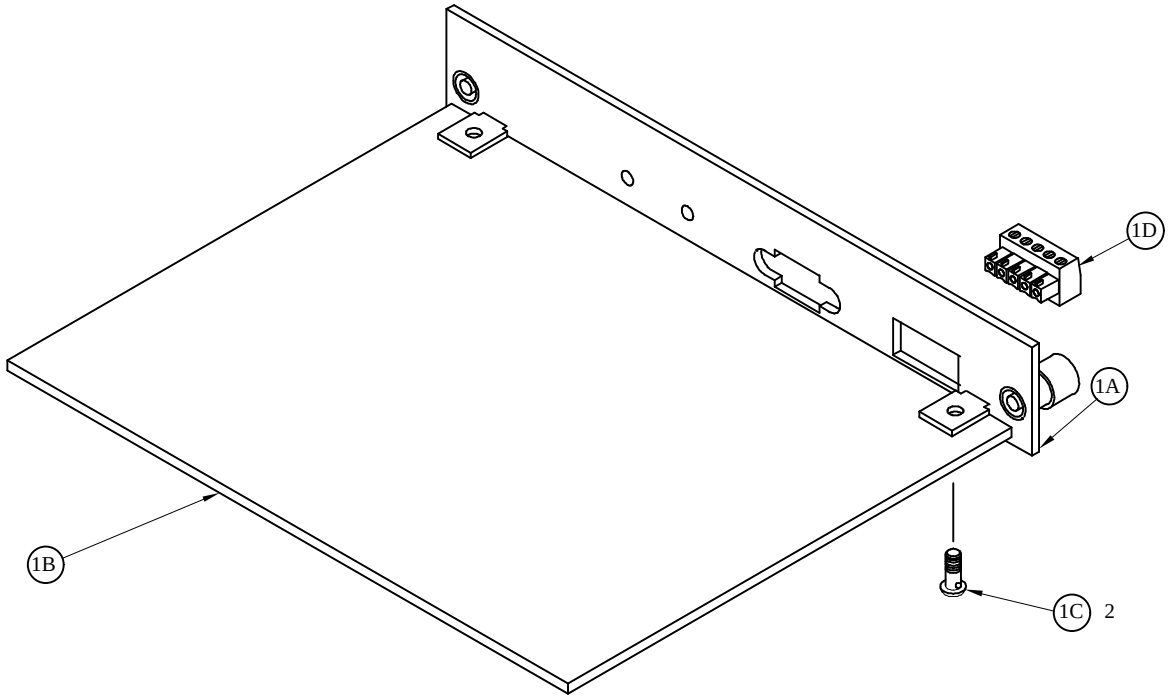
W2 IRQ pulldown. Install on only one board using a shared IRQ. (default = installed).

W3 Select IRQ3, IRQ4, IRQ5, IRQ6 or None
Position 1 to 2 IRQ7
Position 1 to 3 IRQ5
Position 1 to 4 IRQ4
Position 1 to 5 IRQ3 (default)

Status Lights

The PROFIBUS PCB has two status LED's that indicate serial port activity.

PROFIBUS PCB Parts



PROFIBUS PCB Assembly

Ref #	Part Number	Description	QTY
1A	14517000A	I/O Plate	1
1B	14688900A	PCB, PROFIBUS (w/o Hardware)	1
1C	R0511100A	Screw, M4 X 10 Taptite	2
1D	14374900A	Connector, 5-Position Terminal Block	0**
*	14517100A	PROFIBUS PCB Panel Assembly	1

* Includes all parts listed above as an assembly.

** Included with Pigtail Adapter Kit 0900-0311

3 Dual Analog Output Option

Jaguar Dual Analog Output PCB

⚠ WARNING

WHEN THIS EQUIPMENT IS INCLUDED AS A COMPONENT PART OF A SYSTEM, THE DESIGN MUST BE REVIEWED BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF ALL COMPONENTS IN THE SYSTEM AND THE POTENTIAL HAZARDS INVOLVED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

The Jaguar Dual Analog Output PCB option kit provides a two channel isolated 4-20 mA or 0-10 VDC analog signal output for gross weight or displayed weight. The outputs will be low when the displayed weight is at zero. When the displayed weight reaches maximum capacity, the outputs will increase to the maximum (20 mA or 10 VDC). Any weight between zero and full capacity will be represented as a percentage of the output proportional to the percentage of full scale capacity.

The Analog Output sub-block lets you select the data source and calibrate analog zero and full-scale values. The JAGUAR must be calibrated to the desired scale before making any Analog Output adjustments. The Analog PCB has two channels. Channel 1 is typically assigned to Scale 1, and Channel 2 to Scale 2 (if a second scale is being used). In setup, you can assign the scale source of the analog output values to the output channel.

Specifications

Note: If the load resistance ratings are exceeded, the analog output will not operate properly.

Maximum Cable length: 0-10 VDC - 50 ft (15.2 m)

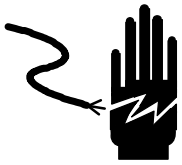
Recommended Load

Resistance: 0-10 VDC - 100k ohms minimum
4-20 mA - 500 ohms maximum

Outputs: Two channels each capable of supplying 4-20 mA or 0-10 VDC.

Installation

To install the Analog Output PCB in the Jaguar:



WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

CAUTION

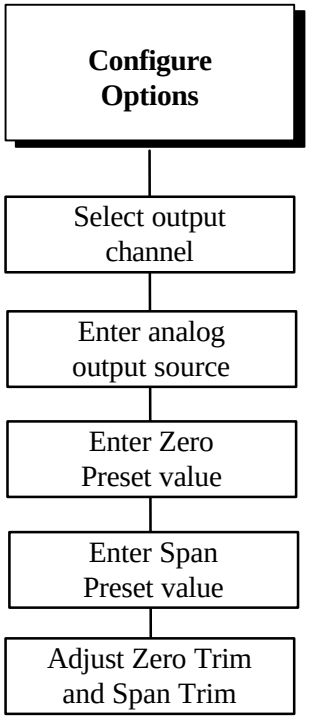
OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

WARNING

DO NOT APPLY POWER TO THE JAGUAR UNTIL INSTALLATION OF COMPONENTS AND EXTERNAL WIRING HAVE BEEN COMPLETED.

1. Disconnect AC Power to the Jaguar.
2. Remove the Jaguar rear panel if installing in a GP (General Purpose) or HE (Harsh Environment) unit. On the Rack Mount only, remove the cover plate from an open slot on the rear of the Jaguar.
3. Insert the Analog Output PCB in an open slot in the rear of the Jaguar. Seat the PCB by inserting the PCB into the slot, then tighten the thumbscrews finger tight.
4. Connect the external wiring to the Analog Output PCB outputs.
5. Install the rear covers on the GP or HE versions.
6. Power up the Jaguar. The Jaguar will recognize the new option PCB automatically. Refer to Setting Up the Jaguar in the next section to configure the Analog Output PCB.

Setup In the Jaguar



To configure the Analog Output option:

1. With Power to the JAGUAR removed, connect a volt or current meter to the appropriate output. If the customer's device is already connected the meter is not necessary.
2. Apply power to the JAGUAR and enter Setup. Press ENTER at the **Config Options** prompt to access the sub-block.
3. Press ENTER at the **Analog Output** prompt, then select the channel for the data source.
4. At the Output Channel prompt, press ENTER to select channel 1 or channel 2.
5. Press ENTER at the **Source?** prompt, then select gross weight display, displayed weight, rate or JagBasic output as the data source for analog output. Press ENTER.
6. Press ENTER at the **Zero Preset** prompt, then enter the actual weight value at which the analog output is to equal 0VDC or 4mA.
7. Press ENTER at the **Span Preset** prompt, then enter a weight value for the analog output to use as the full scale value.
8. Place the weight on the scale (or adjust for the correct displayed weight on a simulator prior to entering Setup) at which the Analog Output is to equal 0VDC or 4mA.
9. Press ENTER at the **Zero Trim** prompt, then at the **Coarse** prompt, press the MEMORY key to increase the output, or press the FUNCTION key to decrease the output. Observe the meter or customer device. Continue to adjust the output until either the correct reading or the closest reading available using coarse adjust displayed. Press ENTER when the desired adjustment is displayed or fine adjust is required.

The target weight must on the scale before making Zero or Span Trim adjustments.

10. At the **Fine** prompt, press the MEMORY key to increase the output, or press the FUNCTION key to decrease the output. Press ENTER when the desired adjustment is displayed.
11. Place the weight on the scale (or exit setup and adjust for the correct displayed weight on a simulator) at which the Analog Output is to equal 10VDC.

The target weight must on the scale before making Zero or Span Trim adjustments.

12. Press ENTER at the **Span Trim** prompt, then at the **Coarse** prompt, press the MEMORY key to increase the output, or press the FUNCTION key to decrease the output. Press ENTER when the desired adjustment is displayed.
13. At the **Fine** prompt, press the MEMORY key to increase the output, or press the FUNCTION key to decrease the output. Press ENTER when the desired adjustment is displayed.

See Appendix 1 for more information on using JagBasic as the source for the Analog Output.

Wiring

⚠ WARNING

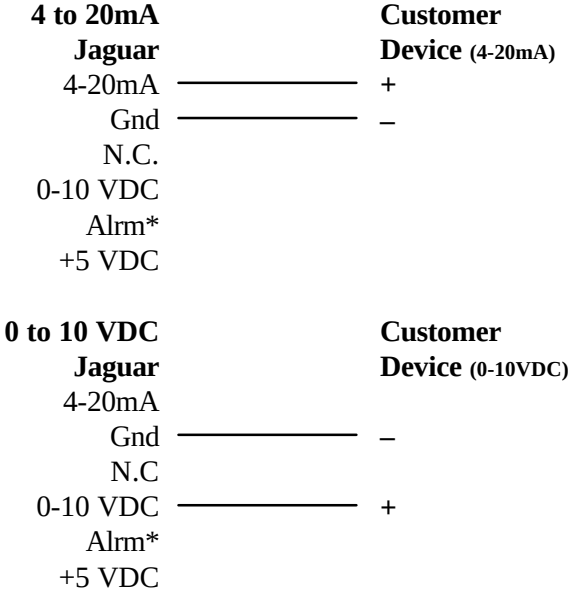
DO NOT APPLY POWER TO THE JAGUAR UNTIL INSTALLATION OF COMPONENTS AND EXTERNAL WIRING HAVE BEEN COMPLETED.

⚠ WARNING

IF THIS DEVICE IS USED IN AN AUTOMATIC OR MANUAL FILLING CYCLE, ALL USERS MUST PROVIDE A HARD WIRED EMERGENCY STOP CIRCUIT OUTSIDE THE DEVICE CIRCUITRY. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

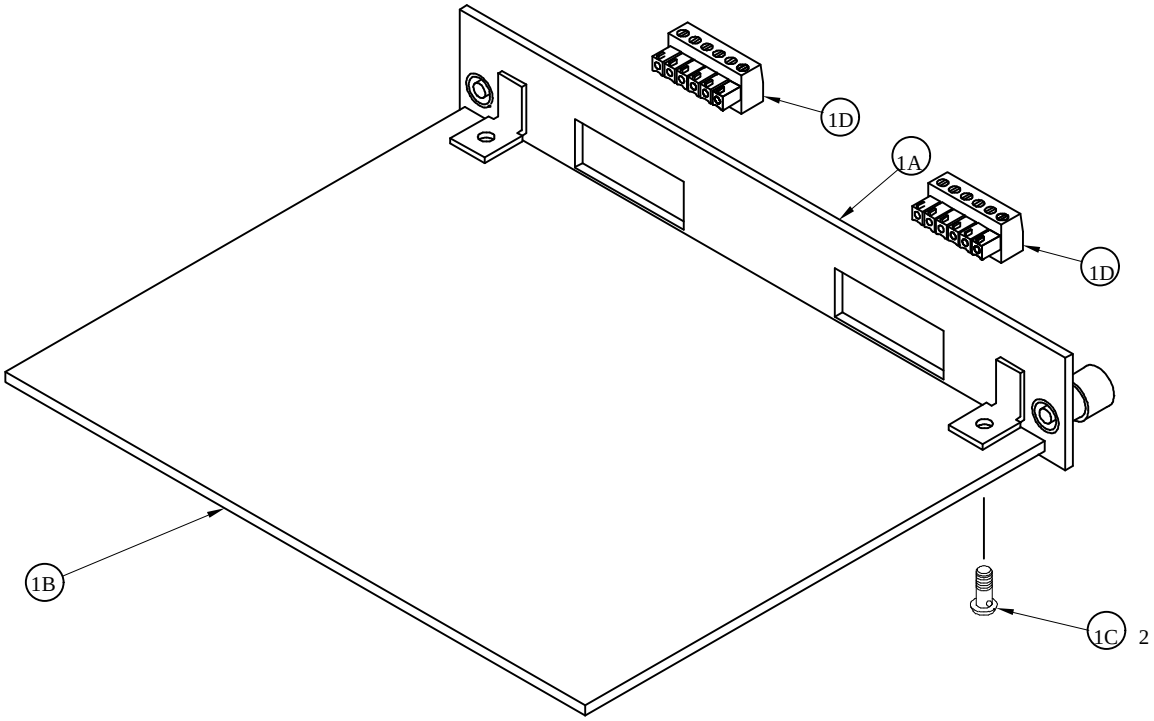
The maximum recommended cable length for the 0-10VDC output is 50 feet (15.2 meters). The recommended cable for use with the analog output is shielded 2-conductor stranded 20 gauge cable (Belden #8762 or equivalent) which is available from Mettler Toledo using part number 510220190.

Wire to **CHAN A** for Scale 1 and to **CHAN B** for Scale 2 as follows:



*The ALRM Output (Alarm) is a normally open connection to the GND Terminal during normal operation. If the JAGUAR weight display goes to an over capacity or under zero display the connection closes and the ALRM Output will be capable of sinking up to 30mA DC. The voltage source can be the +5V supplied with CHAN 1 or 2 of the Analog Output PCB or a maximum of +30VDC external source.

Dual Analog Output PCB Parts



Ref #	Part Number	Description	QTY
1A	14547400A	I/O Plate, Dual Analog	1
1B	14095000A	PCB, Dual Analog Output (w/o Hardware)	1
1C	R0511100A	Screw, M4 X 10 Taptite	2
1D	13162500A	Connector, 6-Position Terminal Block	2
*	14164100A	Dual Analog Output PCB Panel Assembly	1

* Includes all parts listed above as an assembly.

4 Jaguar Modbus Plus

Modbus Plus Overview

Modbus Plus is a local area network designed for industrial control applications. The network enables Modicon Model 984 programmable controllers, host computers, Jaguars, Panthers, and other devices to communicate throughout the production areas of an industrial plant. It supports 64 addressable node devices at a data transfer rate of one million bits per second. Up to 32 devices can connect directly to a network cable with a length of up to 1500 feet.

The Jaguar Modbus Plus Interface is an option card that plugs into the Jaguar. It has a “Peer Processor” that implements the network protocol; an FM Encoder/Decoder; and an RS485 driver that provides the interface to the Modbus Plus network.

A Jaguar Modbus Plus Interface card is a single Modbus Plus node. The hosting Jaguar can support up to four scales within the node. The scales can be any combination of local or remote scales in a Jaguar cluster.

Point-to-point communication in the Modbus Plus network is the communication between two network nodes. The “Master Task” at the initiating node generates a “transaction query” for the “Slave Command Handler Task” at the destination node. The Slave Command Handler Task sends a “transaction response” to the transaction query. Peer Processors route the messages through the network.

The Modbus Plus PLC acts as the Master Task, and the Jaguar has the Slave Command Handler Task. The PLC initiates all transactions, and the Jaguar responds to the transaction queries.

The general format for Modbus transaction query command is a one-byte command followed by a group of data or function bytes. The maximum message length is 252 bytes. The function bytes tell the slave device what action to perform.

Jaguar supports the following Modbus functions:

03 Read Holding Registers
This function requests the value of one or more 16-bit holding registers.

16 Preset Multiple Registers
Place values into a series of consecutive holding registers.

The transaction query messages contain register values that specify what data that the PLC is requesting from the Jaguar. For example, if the PLC issues Function 03, the data field must contain information telling the Jaguar what register number to start at and how many registers to read. All address references within the Modbus messages are relative to zero. For example, the first holding register in the Modicon 984 PLC is 40001, but has the value 0000 in the messages.

The Jaguar must be set up in one of the “integer” weight data modes or in the “floating point” weight data mode. These modes are mutually exclusive, that is, the Modicon PLC can request either integer weight data or the floating point weight data, but cannot request both interchangeably in the same Jaguar setup.

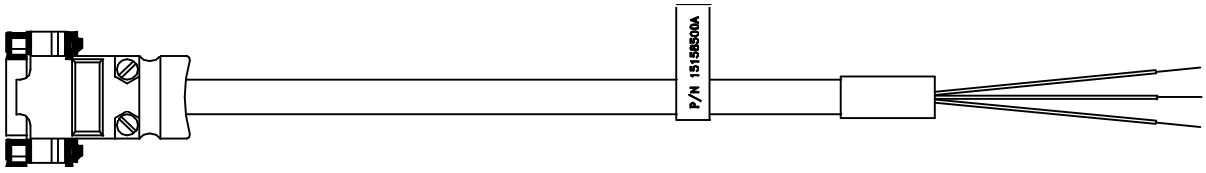
Factory Order Information

The Modbus Plus Interface is available as a factory installed option or field installed kit. To order the Modbus Plus Interface installed in the Jaguar from the factory, substitute a 7 in the Slot 2 or 3 order number. Only one PLC interface option may be installed in a Jaguar Chassis.

```
Factory Number      J T X X - X X X X - X X X
                    | | | |   | | | |   | | |
Jaguar -------------' | | |   | | | |   | | |
Terminal -------------' | |   | | | |   | | |
Enclosure --------------' |   | | | |   | | |
Display ------------------'   | | | |   | | |
                              | | | |   | | |
Board Slot 1 -----------------' | | |   | | |
                                | | |   | | |
Board Slot 2 -------------------' | |   | | |
   5 = Modbus Plus                | |   | | |
Board Slot 3 ---------------------' |   | | |
   5 = Modbus Plus                  |   | | |
Optional Mode ----------------------'   | | |
                                        | | |
Market ---------------------------------'-'-'
```

To order the Modbus Plus as a field installed kit, use factory number 0917-0254. The Modbus Pigtail Cable kit is 0900-0320 is available for use in the Jaguar GP and HE enclosures.

The 0900-0320 Pigtail Cable is shown below.



WIRE TERMINATION LIST					
FROM		**TO**			**CONDUCTOR**
POINT 1	**END 1**	**POINT 1**	**END 1**	**MATERIAL**	**COLOR**
P1-1	10856700A	- - -	¼" STRIP	14215700A	WHITE
P1-3	10856700A	- - -	¼" STRIP	14215700A	BLACK
P1-2	10856700A	- - -	SOLDER	14215700A	DRAIN
1G	¼" STRIP	- - -	SOLDER	14191600A	GREEN

Discrete Read/Write Format

The Jaguar can communicate weight to the PLC in a discrete ***integer weight format***. The Modbus Plus uses Discrete Data Transfer that allows for bi-directional communication of discrete bit encoded information or 16-bit binary word (signed integer) numerical values.

On Modbus Plus, there are two words (32 bits) of input data for each scale and two words of output data for each scale. Since the Jaguar is a single Modbus Plus node, it can support up to four scales within a node. The scales can be any combination of local or remote scales in a Jaguar cluster. In a four scale configuration, at least two on the scales are in a remote Jaguar connected to the host Jaguar over an ARCnet LAN.

The Modicon PLC uses these holding registers assignments to request integer weight and scale status from the Jaguar.

40001 Scale 1 Integer Weight
40002 Scale 1 Status
40003 Scale 2 Integer Weight
40004 Scale 2 Status
40005 Scale 3 Integer Weight
40006 Scale 3 Status
40007 Scale 4 Integer Weight
40008 Scale 4 Status

The Modicon PLC uses these holding registers assignments to send “bit-oriented” commands and associated integer values to the Jaguar.

40009 Scale 1 Integer Tare or Setpoint Value
40010 Scale 1 Bit-Oriented Commands
40011 Scale 2 Integer Tare or Setpoint Value
40012 Scale 2 Bit-Oriented Command
40013 Scale 3 Integer Tare or Setpoint Value
40014 Scale 3 Bit-Oriented Command
40015 Scale 4 Integer Tare or Setpoint Value
40016 Scale 4 Bit-Oriented Command

The data in these input and output words is formatted as shown in the following tables.

DISCRETE READ - JAGUAR Output to PLC Input		
Bit Numbers	**Word 0**[1]	**Word 1**
0	Signed 16 Bit Integer Weight Data	Setpoint 1
1		Setpoint 2
2		Setpoint 3
3		Setpoint 4
4		Setpoint 5
5		Setpoint 6
6		Setpoint 7
7		Setpoint 8
8		ESC Key[2]
9		PAR 1.1[3]
10		PAR 1.2[3]
11		PAR 1.3[3]
12		Motion[4]
13		Net Mode[5]
14		Update in Progress[6]
15		Data OK[7]

1. Word 0 is a sixteen-bit signed integer that may represent the scale gross, net, tare, rate, setpoint #1, or displayed weight. Three bits, set by the PLC, designate data sent by the Jaguar.
2. Bit 8 is set to a 1 when the ESCAPE key is pressed on the keypad of the Jaguar where the PLC option is installed. The bit will be cleared to 0 when the display mode bits (see next table) change from 0 to a non-zero value.
3. Bits 9, 10, and 11 mirror the state of the first three input bits on the controller board of the Jaguar. These are labeled IN1, IN2, and IN3. If the input is ON (input grounded) then the bit is set to a 1.
4. Bit 12 is set to a 1 when the scale is unstable.
5. Bit 13 is set to a 1 when the scale is in the net mode.
6. Bit 14 - When this flag is 1, the PLC scanner has read the data while the Jaguar is in the middle of updating the data. The PLC should ignore the data in this case and simply re-scan the data.
7. Bit 15 is set to a 1 when the scale is operating properly, not over or under capacity, and not in power up or expanded weight mode. The PLC program should continuously monitor this bit to determine the validity of the data.

DISCRETE WRITE - PLC Output to JAGUAR Input		
Bit Numbers	**Word 0**	**Word 1**
0	Signed 16 Bit Integer Tare	Select 1[1]
1		Select 2[1]
2		Select 3[1]
3		Load Preset Tare[10]
4		Clear Command[2]
5		Tare Command[3]
6		Print Command[4]
7		Zero Command[5]
8		Disable Setpoint[6]
9		Display Mode[8]
10		Display Mode[8]
11		Display Mode[8]
12		PAR 2.1[9]
13		PAR 2.2[9]
14		PAR 2.3[9]
15		Load SP-1 Value[7]

1. A binary value in bits 0-2 select the data in Discrete Read WORD 0. 0 = gross weight, 1 = net weight, 2 = displayed weight, 3 = tare weight, 4 = setpoint 1, 5 = rate. Values greater than five are gross weight.
2. A transition from 0 to 1 causes a “clear” (return to gross) command.
3. A transition from 0 to 1 causes a “automatic tare” command.
4. A transition from 0 to 1 causes a “print” command.
5. A transition from 0 to 1 causes a “zero” command.
6. Set Bit 8 to 0 to disable the setpoint outputs. Set Bit 8 to 1 to enable the setpoint outputs.
7. A transition from 0 to 1 loads the value in WORD 0 into setpoint 1 value in Jaguar.
8. Bits 9, 10, and 11 determine how the data is displayed in the lower display area. 0 = normal display mode, 1 = display literal 1, 2 = display literal 2, 3 = display literal 3, 4 = display literal 4, 5 = display literal 5, 6 = reserved, 7 = display from block transfer input. Pressing ESCAPE also clears the display to normal mode. Display literals may be pre-programmed in Jaguar setup through the Configure Memory program block. Literals may also be sent to Jaguar from the PLC (lit01, lit02, lit03, lit04, or lit05).
9. Bits 12, 13, and 14 control the state of the first three output bits on the controller board of the Jaguar where the PLC option card is installed. These are labeled OUT1, OUT2, and OUT3. A 1 causes the output to be turned ON.
10. A transition from 0 to 1 loads the value in WORD 0 into the preset tare register.

Floating Point Weight Format

The Jaguar can communicate weight to the PLC in a floating point weight format with integer commands. The Jaguar must set up in the “floating point” weight mode.

The PLC issues a command for a particular scale by setting a Scale Command in the PLC Output Message. Each Command is a two-byte integer, and there is a separate Command for each scale. The Jaguar recognizes a new command from the PLC when it sees a new value in the Scale Command register. If the Command has an associated floating point value, the PLC must set the value in the floating point output register before issuing the Command.

The Jaguar acknowledges each non-Null command from the PLC. After processing a command for a particular scale, the Jaguar sets a new value in the Command Acknowledge bits for the scale in the PLC Input Message. The PLC must wait for the command acknowledgment before issuing a new command.

The PLC can select a rotation of up to nine floating point, real-time input fields from each scale. Real-time fields are the weight and rate fields. For example, the PLC can alternatively look at weight and rate by issuing commands to place both in the rotation. The Jaguar stores the rotation in Shared Data so that the rotation does not have to be reinitialized after each power cycle. When the PLC does not set up an input rotation, the default input rotation consists of gross weight only

The PLC may request that the Jaguar continually cycle among the fields of the input rotation by setting command 0. Then the Jaguar will automatically select the next field from the input rotation at the next A-to-D update. For example, the A-to-D update rate for an Analog Scale is 17 hertz when the Application Type is set to Process Application. Then, the PLC application must be ready to process the next input field in 58 milliseconds.

To control the pace of the input rotation, PLC may request the next field from the input rotation by alternating between commands 1 and 2. The PLC needs to change the command value so that the Jaguar knows when the PLC is requesting a new field. Then, the PLC controls when the Jaguar switches to the next field of input rotation.

Commands 10 through 29 are “Report Data” commands. As long as one of the Report Data commands is in the Scale Command, the Jaguar will report the requested data and will not report data from the input rotation.

When the PLC requests a real-time field from the Jaguar, the Jaguar acknowledges the command only once but sends a new value for that field at every analog-to-digital weight update. The PLC requests real-time fields either through the report data command or through the input rotation.

When the PLC requests a static field from the Jaguar, the Jaguar acknowledges the command once and sets a new value for that field in the output register

once. However, that value remains in the output register until the PLC issues another command. Examples of static fields are setpoint and filter values.

After acknowledging the previous command, the Jaguar will act on a new command only when the PLC sets a new value in a Scale Command in the PLC Output message.

In weight-synchronous mode, PROFIBUS and Modicon PLC's can set and retrieve Jaguar “Shared Data” variables, and can write operator lead-through messages on the lower Jaguar display. The PLC Output Message has additional fields for accessing Shared Data. The PLC must specify the Shared Data command and variable name in the PLC Output Message. If the command is a write command, then the PLC Output Message must also contain the write data field. Its maximum length is 20 bytes. Similarly, when the shared data command is a read command, the PLC Input Message has a read field containing the data read from Shared Data. Its maximum length is 20 bytes. The Shared Data variables are “self-typing”; that is, the Jaguar determines the type of any valid data field in the message from the variable’s name and definition in Shared Data.

Jaguar to Modbus Data Transfer Registers

The Modicon PLC uses these holding registers assignments to request floating point weight and scale status from the Jaguar. The PLC Input Message has four “scale slots”.

40020	Scale Slot 1 Command Response
40021-40022	Scale Slot 1 Single-Precision Floating Point Value
40023	Scale Slot 1 Status
40024	Scale Slot 2 Command Response
40025-40026	Scale Slot 2 Single-Precision Floating Point Value
40027	Scale Slot 2 Status
40028	Scale Slot 3 Command Response
40029-40030	Scale Slot 3 Single-Precision Floating Point Value
40031	Scale Slot 3 Status
40032	Scale Slot 4 Command Response
40033-40034	Scale Slot 4 Single-Precision Floating Point Value
40035	Scale Slot 4 Status

The PLC Output Message has four “scale slots” for Modbus Plus messages. Typically, one slot per scale is assigned in the Jaguar “Config Options” menu. However, the bandwidth of the I/O channel can be increased by selecting only one or two scales in the “Config Options” menu. The Jaguar uses the following criteria for assigning scale slots to scales:

- If the user selects one scale in the “Config Options” menu, then the Jaguar assigns slots 1 and 2 for communicating the scale data with the PLC.
- If the user selects two scales in a Modbus Plus configuration, then the Jaguar assigns slots 1 and 3 for communicating scale 1 data with the PLC; and it assigns slots 2 and 4 for communicating scale 2 data with the PLC.

- If the user selects more than two scales in a Modbus Plus configuration, then the Jaguar assigns one scale per scale slot.

Scale Input Status Format

The Jaguar sets the following status's in response to scale commands.

Command Response

Bits 0-7	Reserved
Bit 8	Floating Point Input Indicator
Bit 9	Floating Point Input Indicator
Bit 10	Floating Point Input Indicator
Bit 11	Floating Point Input Indicator
Bit 12	Floating Point Input Indicator
Bit 13	Data Integrity Bit 1 [8]
Bit 14	Command Acknowledge 1
Bit 15	Command Acknowledge 2

Scale Status

Bit 0	Setpoint 1 Feeding
Bit 1	Setpoint 2 Feeding
Bit 2	Setpoint 1 Fast Feeding
Bit 3	Setpoint 2 Fast Feeding
Bit 4	Setpoint 1 In Tolerance
Bit 5	Scale Selected (weight on local Jaguar display)
Bit 6	JagBasic Custom Bit 1
Bit 7	JagBasic Custom Bit 2
Bit 8	Escape Keystroke
Bit 9	Discrete Input 1
Bit 10	Discrete Input 2
Bit 11	Discrete Input 3
Bit 12	Motion
Bit 13	Net
Bit 14	Data Integrity Bit 2 [8]
Bit 15	Data OK/Error Indication

Note:

8. Data Integrity Bits required for Allen-Bradley PLC-5 Remote I/O Scanner. Both bits must have the same polarity for the data to be valid.

After processing a PLC Command, the Jaguar acknowledges it by setting a new value in the two Command Acknowledge bits. The Jaguar rotates sequentially among values 1, 2, 3, 1, 2, 3, 1, 2, ... to acknowledge that it has recognized and processed a new, non-Null Command. When the PLC sees a new, non-zero value in the Command Acknowledge bits, it must verify the value is in sequence to confirm that the Jaguar has successfully completed the last command. The default value for the Command Acknowledge bits is 0.

The Floating Point Input Indicator bits tell the PLC what value is currently in Scale Single-Precision Floating Point Value. The PLC can set up a rotation of up to nine different fields by sending output commands to the Jaguar. Values 0, 1, 2, 3, 4, 5, 6, 7, and 8 represent floating point fields that may be part of the

input rotation. The PLC can also issue a command to request that the Jaguar report a specific value. The Floating Point Input Indicator bits can have the following values:

0	Gross Weight [9]
1	Net Weight [9]
2	Tare Weight [9]
3	Fine Gross Weight [9]
4	Fine Net Weight [9]
5	Fine Tare Weight [9]
6	Rate [9]
7	JagBasic Custom Variable 1 [9]
8	JagBasic Custom Variable 2 [9]
9	JagBasic Custom Variable 3
10	JagBasic Custom Variable 4
11	Low-Pass Filter Corner Frequency
12	Notch Filter Frequency
13	Setpoint 1 Coincidence
14	Setpoint 2 Coincidence
15	Setpoint 1 Dribble
16	Setpoint 2 Dribble
17	Setpoint 1 Tolerance
18	Primary Units-Low Increment Size
19-28	Reserved
29	Last Jaguar Error Code
30	No Data Response - Command Successful
31	No Data Response - Command Failed

Note:

9. Indicates real-time fields that the PLC may request either through the input rotation or through “report” commands. The PLC may request the other fields only from the “report” commands.

There are two custom status bits that a JagBasic application can use to communicate special status’s to the PLC. Use them wisely. The JagBasic application and PLC define the meaning of these bits.

The Data OK/Error indication bit reports scale over capacity, scale under zero, scale communication, and cluster communication off-line error conditions. When the PLC sees an error indication, it can send a command to the Jaguar to get the latest error status.

Modbus to Jaguar Floating Point Data Transfer Registers

The Modicon PLC uses these holding registers assignments to send integer commands and associated single-precision floating point values to the Jaguar. The PLC Output Message has four “scale slots”.

40047	Scale Slot 1 Command
40048-40049	Scale Slot 1 Single-Precision Floating Point Value

40050	Scale Slot 2 Command
40051-40052	Scale Slot 2 Single-Precision Floating Point Value
40053	Scale Slot 3 Command
40054-40055	Scale Slot 3 Single-Precision Floating Point Value
40056	Scale Slot 4 Command
40057-40058	Scale Slot 4 Single-Precision Floating Point Value

PLC Output Scale Commands

Dec	Hex	Command
0	00	Report next field from input rotation at next A/D update [7]
1	01	Report next field from input rotation [6, 7]
2	02	Report next field from input rotation [6, 7]
3	03	Reset Input Rotation
10	0a	Report Gross Weight [2, 7]
11	0b	Report Net Weight [2, 7]
12	0c	Report Tare Weight [2, 7]
13	0d	Report Fine Gross Weight [2, 7]
14	0e	Report Fine Net Weight [2. 7]
15	0f	Report Fine Tare Weight [2, 7]
16	10	Report Rate [2, 7]
17	11	Report JagBasic Custom Input 1 to PLC [2, 7]
18	12	Report JagBasic Custom Input 2 to PLC [2, 7]
19	13	Report Low-Pass Filter Corner Frequency [2]
20	14	Report Notch Filter Frequency [2]
21	15	Report Setpoint 1 Coincidence Value [2, 4]
22	16	Report Setpoint 2 Coincidence Value [2, 4]
23	17	Report Setpoint 1 Dribble Value [2, 4]
24	18	Report Setpoint 2 Dribble Value [2, 4]
25	19	Report Setpoint 1 Tolerance Value [2, 4]
27	1b	Report JagBasic Custom Input 3 to PLC [2]
28	1c	Report JagBasic Custom Input 4 to PLC [2]
29	1d	Report Error After Error Indication [2]
30	1e	Report Primary Units - Low Increment Size [2]
40	28	Add Gross Weight to Input Rotation
41	29	Add Net Weight to Input Rotation
42	2a	Add Tare Weight to Input Rotation
43	2b	Add Fine Gross Weight to Input Rotation
44	2c	Add Fine Net Weight to Input Rotation
45	2d	Add Fine Tare Weight to Input Rotation
46	2e	Add Rate to Input Rotation
47	2f	Add JagBasic Custom Input 1 to PLC to Input Rotation
48	30	Add JagBasic Custom Input 2 to PLC to Input Rotation
60	3c	Set Programmable Tare [3]
61	3d	Set Push-Button Tare
62	3e	Clear Command
63	3f	Print Command
64	40	Zero Command
65	41	Select Scale A
66	42	Select Scale B
67	43	Select Other Scale
68	44	Custom Print 1 Command
69	45	Custom Print 2 Command
70	46	Custom Print 3 Command

71	47	Custom Print 4 Command
72	48	Custom Print 5 Command
73	49	Set Low-Pass Filter Corner Frequency [3]
74	4a	Set Notch Filter Frequency [3]
75	4b	Reset Escape Key
78	4e	Disable Error Display
79	4f	Enable Error Display
80	50	Set Normal Display Mode
81	51	Display Literal 1
82	52	Display Literal 2
83	53	Display Literal 3
84	54	Display Literal 4
85	55	Display Literal 5
87	57	Display Literal in Shared Data Block of Message
88	58	Disable Numeric Display
89	59	Enable Numeric Display
90	5a	Set Discrete Output 1 = ON
91	5b	Set Discrete Output 2 = ON
92	5c	Set Discrete Output 3 = ON
93	5d	Set Discrete Output 4 = ON
100	64	Set Discrete Output 1 = OFF
101	65	Set Discrete Output 2 = OFF
102	66	Set Discrete Output 3 = OFF
103	67	Set Discrete Output 4 = OFF
110	6e	Set Setpoint 1 Coincidence Value [3, 4]
111	6f	Set Setpoint 1 Dribble Value [3, 4]
112	70	Set Setpoint 1 Tolerance Value [3, 4]
114	72	Setpoint 1 = Enabled [4]
115	73	Setpoint 1 = Disabled [4]
116	74	Setpoint 1 = Gross Weight [4]
117	75	Setpoint 1 = Net Weight [4]
118	76	Setpoint 1 = Rate [4]
119	77	Setpoint 1 = Filling [4]
120	78	Setpoint 1 = Discharging [4]
121	79	Setpoint 1 = Latching Enabled [4]
122	7a	Setpoint 1 = Latching Disabled [4]
123	7b	Setpoint 1 = Reset Latch [4]
130	82	Set Setpoint 2 Coincidence Value [3, 4]
131	83	Set Setpoint 2 Dribble Value [3, 4]
134	86	Setpoint 2 = Enabled [4]
135	87	Setpoint 2 = Disabled [4]
136	88	Setpoint 2 = Gross Weight [4]
137	89	Setpoint 2 = Net Weight [4]
138	8a	Setpoint 2 = Rate [4]
139	8b	Setpoint 2 = Filling [4]
140	8c	Setpoint 2 = Discharging [4]
141	8d	Setpoint 2 = Latching Enabled [4]
142	8e	Setpoint 2 = Latching Disabled [4]
143	8f	Setpoint 2 = Reset Latch [4]
150	96	Set JagBasic Custom Output 1 From PLC [5]
151	97	Set JagBasic Custom Output 2 From PLC [5]
152	98	Set JagBasic Custom Output 3 From PLC [5]
153	99	Set JagBasic Custom Output 4 From PLC [5]
160	a0	Apply Scale Setup
161	a1	Write Scale Calibration to EEPROM

162	a2	Disable Tare from Control Panel
163	a3	Enable Tare from Control Panel

Notes:

2. A command requiring the Jaguar to report a specific value in the PLC input message. As long as one of these commands is in the Scale Command, the Jaguar will respond with the requested data and not with data from the input rotation.
3. A command requiring a floating point value output from the PLC to the Jaguar. The Jaguar reflects back the floating point value in the floating point register of input message to the PLC.
4. Indicates that the setpoint numbers are relative to each scale in the Jaguar. Scale A uses Setpoints 1 and 2. Scale B uses Setpoints 3 and 4.
5. A command in which a JagBasic Application and the PLC define the format of the data which has a length of four bytes.
6. A command used by the PLC to select the next field from the input rotation. The PLC must alternate between these two commands to tell the Jaguar when to switch to the next field of the input rotation.
7. A command that requests real-time fields from the Jaguar. The Jaguar updates the input register to the PLC at the A/D update rate of scale.

PLC Output Message Shared Data Command

The PLC Output Message Shared Data Command is an integer field that initiates Shared Data access operations at the Jaguar. Shared Data commands in Modbus Plus can be issued for any Jaguar weight format configuration, integer or floating point.

The Jaguar processes a Shared Data commands “on demand” by the PLC. The Jaguar processes a new Shared Data command when the PLC puts a new value in the “Shared Data Command” field. The Jaguar does not provide “real time” Shared Data access where the Jaguar automatically sends new values to the PLC. The PLC must request each new access by setting a new value in the command field. To do successive reads, for example, the PLC must set alternately set a “null command” and a “read command” in the command field. For most efficient processing, the PLC should set a “null command” in the command field while it is setting the Jaguar name, variable name, and value in the output message. Once these variables are properly set up, the PLC should then set the command field to a “read command” or “write command”.

The Shared Data Command can have the following values:

0	Null Command
1	Read Shared Data
2	Write Shared Data
3	Write Jaguar Lower Display

Before sending a Shared Data Command to write to the Jaguar Lower Display, the PLC must issue command 57 in the Scale Commands to put the Jaguar in the mode of writing messages from the PLC Shared Data to the Lower Display.

PLC Output Message Shared Data Command Registers

40059	Shared Data Command
40060	Shared Data Field Name - Remote Jaguar Name
40061-40063	Shared Data Field Name - Variable Name
40064-40073	Shared Data Write Value

PLC Input Message Shared Data Command

The PLC uses the following holding registers to retrieve the status of a Shared Data access command. When the Shared Data command is a read command, these registers also return the data field read from Shared Data. The maximum length of the read data field is 20 bytes. You need to issue the MSTR Read command to get these shared data registers from the Jaguar.

40036	Shared Data Access Status
40037-40046	Shared Data Read Field Value

PLC Input Shared Data Status

The PLC Input Shared Data Status is an integer field that gives the status of the last Shared Data operation. The Jaguar supports this status for Profibus and Mobus Plus communications. It has the following values:

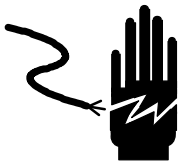
0 Null Status
1 Command Completed Successfully
2 Invalid Shared Data Name
3 Invalid Shared Data Command
4 Cannot Write Because This Is A Legal-For-Trade Field
5 Cannot Access Remote Jaguar

Global Data

Jaguar supports Modbus Plus Global Data as an option. The Jaguar writes to Global Data, but never reads Global Data. Global Data from one Modbus Plus node is continuously available to all other nodes on the network. Use of Global Data can make programming the PLC somewhat simpler since with this option the PLC need not continuously issue commands to read the Jaguar registers. The PLC must still issue MSTR commands to send commands to the Jaguar.

The user selects the Global Data option in the setup menus. When the user selects the integer data format, the Jaguar duplicates the integer “Jaguar-to-PLC” data transfer registers into the global data. When the user selects the floating point data format, the Jaguar duplicates the floating point “Jaguar-to-PLC” data transfer registers into the global data.

Modbus Plus PCB Installation



WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

WARNING

DO NOT APPLY POWER TO THE JAGUAR UNTIL INSTALLATION OF COMPONENTS AND EXTERNAL WIRING HAVE BEEN COMPLETED.

To install the Modbus Plus PCB in the Jaguar:

- First disconnect power to the Jaguar by disconnecting the AC power cord from either the rear of the Jaguar, or at the AC outlet.
- Remove the Jaguar rear panel if installing in a GP (General Purpose) or HE (Harsh Environment) unit.
- Set the Jumpers on the PCB (Refer to Jumper Settings Section).
- Insert the PCB in slot 2 or 3 of the Jaguar.
- Tighten the two thumbscrews until the PCB is completely seated in the backplane connector.
- Connect the I/O wiring.
- Reconnect AC power.

Enter Setup and configure the Modbus Plus options (Refer to the Jaguar Setup).

Jaguar Setup

The Jaguar user must set up the Jaguar in one of the “integer” weight data modes or in the “floating point” weight data mode using the Jaguar setup menus. The modes are mutually exclusive. That is, the PLC and Jaguar can communicate using either integer weight data or the floating point weight data, but cannot communicate using both interchangeably in the same Jaguar setup.

Depending on the type of PLC communications, the operator uses one of these new Jaguar setup menu sequences to select the floating point weight format. The Jaguar automatically determines the type of PLC communications, if any, by polling the hardware configuration.

Config Options

Modbus Plus

Scale Setup

Data Format? Wgt/Div/Ext/Flt

In the Global Data option, the Jaguar duplicates the integer or floating point (depending on the data type selected above) data transfer registers into the network global data.

Config Options

Modbus Plus

Scale Setup

Globals? Y/N

The Modbus Plus Interface card node is set in hardware only. The installer view but not modify the Modbus Plus device address using the “Rack Address” menu selection.

Config Options

Modbus Plus

Node Communicate

Rack Address?

Switch Setup

Each node on the Modbus Plus network must have a unique address. The Jaguar Modbus Plus node address is set with the "dip switches" on the Modbus Plus interface card. The node address value of the card is equal to the value of the switches plus 1 and it can be equal to a value of 1 to 64.

Switch pos.	1	2	3	4	5	6
value	1	2	4	8	16	32

With the switch in the OFF position, the value is as shown above. With the switch in the ON position, the value is zero for that switch.

Example:		
SW1 = OFF	Switch Value =	1
SW2 = ON		0
SW3 = ON		0
SW4 = OFF		8
SW5 = OFF		16
SW6 = ON		0
	(PLUS 1)	+1
	NODE ADDRESS =	26

Note: With all of the switches in the OFF position, the node address will be equal to 1.

Status Light

There is a green diagnostic LED on the Jaguar Modbus Plus Options board, viewable through a small hole in the interface mounting bracket at the rear of the Jaguar. The repetitive flashing patterns have the following meanings.

- Flash every 160 milliseconds. The Jaguar node is working normally in that it is successfully receiving and passing the token. Every node on the link should be flashing this same pattern.
- Flash every 1 second. The Jaguar node is in an off-line state where it must monitor the link for 5 seconds. During this period, it hears all active nodes on the network and is building the active station table.
- Two flashes, off for 2 seconds. The Jaguar node is permanently in an idle, never-getting-token state. It is hearing the other nodes but is never getting the token itself. This Jaguar node may have a bad transmitter.
- Three flashes, off for 1.7 seconds. This Jaguar node is not hearing any other nodes so it is periodically claiming and winning the token, and then finding no other node to send it to. It could be that this is the only node on the link, or that there are other nodes and this has node a bad receiver or bad network connection. The latter situation could be disruptive to the entire network.
- Four flashes, off for 1.4 seconds. This Jaguar node has heard a valid packet that was a duplicate-node-address sent from another node on the network. The node is now in an off-line state where it will remain passively monitoring the link, until it has not heard the duplicate node for 5 seconds.

Wiring to the Jaguar

The Modbus Plus network uses pins 1, 2, and 3 of the DE-9 connector, supplied by Modicon. Wiring instructions come with the connector.

The Modbus Plus pigtail is wired to the Jaguar as follows:

DE-9	Terminal Strip	
1	Red	1
2	Clear	2
3	Black	3

Modicon 984-385E Setup Example

A Modbus Plus network cable connects the Jaguar Modbus Plus Interface to the Modbus Plus port on the 984-385E Programmable Controller Module. The Modicon Modbus Plus Network Planning and Installation Guide, Part Number GM-MBPL-001, describes the network cabling, the terminating connectors, and the in-line connectors needed to build a network cable.

Set the node address for the 984-385E PLC using the DIP switches on the bottom of the Programmable Controller Module.

The Modbus Plus Indicator on the 984-385E front panel indicates a good connection to the Jaguar when it is constantly flashing green. There is also a green diagnostic LED on the Jaguar Modbus Plus Options card. The Jaguar has made a good network connection when it constantly flashes the green LED every 160 milliseconds.

Modsoft Programming Software running on a PC controls the Modicon 984-385E PLC. A serial cable connects a serial port on the PC to the Modbus port on the PLC. The Modsoft Programmer User Manual , Part Number 890-USE-115-00 Version 1.0, describes in detail how to use Modsoft. Use version 2.32 or a later version of the Modsoft software. Perform the following steps from Modsoft to read and write to a Jaguar on the Modbus Plus network from a Modicon 984-385 PLC:

With Modsoft running on a PC, go to the Configuration Overview screen and select the 984-385E PLC.

Switch to the Configuration Overview - Ports menu, and change the Modbus port to Bridge mode. This allows commands issued from Modsoft to be transferred to the Modbus Plus network.

From the Modsoft main menu, go “on-line” to the 984-385E PLC from Modsoft.

Once a successful connection has been made, use the MSTR instruction to access the Jaguar. The Modicon Ladder Logic Block Library User Guide, Part Number “840 USE 101 00 Version 1.0” gives detailed information about the MSTR instruction.

MSTR Instruction Example to Read Jaguar Integer Registers

This example shows using the MSTR instruction to read the integer status and weight registers in the Jaguar. In this example, Jaguar is at node 2 in the dip switches on the Jaguar Modbus Plus interface card. The user must configure the Jaguar to run in integer mode using the <Config Options><Modbus Plus><Scale Setup><Data Format?> menus. This MSTR reads the holding registers for four scales in integer mode.

Control Block

Register	Content	
40001	0002 Dec	Read command
40002	xxxx Hex	Error status
40003	0008 Dec	Number of registers to be read
40004	0001 Dec	Starting address of integer weight/status registers in the Jaguar. (1 = 40001).
40005	0002 Hex	Routing path. Jaguar address = node 2.
40006	0001 Dec	Data slave routing path.
40007	0000 Dec	Additional routing register
40008	0000 Dec	Additional routing register
40009	0000 Dec	Additional routing register

Data Area

Register	
40100	The PLC stores registers read from the Jaguar starting here.

Length

0008	This integer value defines the length of the Data Area.

MSTR Instruction Example to Write Jaguar Integer Registers

This example shows using the MSTR instruction to write the integer command registers in the Jaguar. In this example, the Jaguar address is set to node 2. The user must configure the Jaguar to run in integer mode using the <Config Options><Modbus Plus><Scale Setup><Data Format?> menus. This MSTR writes the holding registers for four scales in integer mode.

Control Block

Register	Content	
40011	0001 Dec	Write command
40012	xxxx Hex	Error status
40013	0008 Dec	Number of registers to be read
40014	0009 Dec	Starting address of integer command registers in the Jaguar. (9 = 40009)
40015	0002 Hex	Routing path. Jaguar address = node 2.
40016	0001 Dec	Data slave routing path.
40017	0000 Dec	Additional routing register
40018	0000 Dec	Additional routing register
40019	0000 Dec	Additional routing register

Data Area

Register

40150	MSTR writes data from registers starting at this address.

Length

0008	This value defines the length of the Data Area.

MSTR Instruction Example to Read Jaguar Floating Point Registers

This example shows how to use the MSTR instruction to read the floating point registers in the Jaguar. In this example, Jaguar is at node 3. The user must configure the Jaguar to run in floating point mode using the <Config Options><Modbus Plus><Scale Setup><Data Format?> menus. This MSTR command reads the Jaguar floating point status and weight registers for scale1 and scale 2.

Control Block

Register	Content	
40021	0002 Dec	Read command
40022	xxxx Hex	Error status
40023	0006 Dec	Number of registers to be read
40024	0020 Dec	Starting register for Jaguar status and floating point weight registers. (20 = 40020).
40025	0003 Hex	Routing path. Jaguar address = node 3
40026	0001 Dec	Data slave routing path.
40027	0000 Dec	Additional routing register
40028	0000 Dec	Additional routing register
40029	0000 Dec	Additional routing register

Data Area

Register	
40200	The PLC stores registers read from the Jaguar starting here.

Length

0006	This value defines the length of the Data Area.

MSTR Instruction Example to Write Jaguar Floating Point Registers

This example shows how to use the MSTR instruction to write to the floating point command registers in the Jaguar. In this example, Jaguar is at node 3. The user must configure the Jaguar to run in floating point mode using the <Config Options><Modbus Plus><Scale Setup><Data Format?> menus. This example writes to the floating point command registers for scale1 and scale 2.

Control Block

Register	Content	
40031	0001 Dec	Write command
40032	xxxx Hex	Error status
40033	0006 Dec	Number of registers to be written
40034	0047 Dec	Starting register for Jaguar floating point command registers. (47 = 40047).
40035	0003 Hex	Routing path. Jaguar address = node 3
40036	0001 Hex	Data slave routing path.
40037	0000 Dec	Additional routing register
40038	0000 Dec	Additional routing register
40039	0000 Dec	Additional routing register

Data Area

Register	
40300	The starting register containing the data to be written.

Length

0006	This integer value defines the length of the Data Area.

Quantum 242 02 PLC with NOM 211 00 Module

The Jaguar routing path in the MSTR command may be different when the Quantum 242 02 PLC has a NOM 211 00 module. Both the NOM 211 00 module and the Quantum 242 02 PLC have Modbus Plus ports. If the Jaguar connects to the PLC through the Modbus Plus port on the Quantum 242 02 Controller card, then there is no change to the routing paths as shown in the examples for a Modicon 984-385E.

If the Jaguar connects to the PLC though the NOM 211 00 Modbus Plus Port, then the routing path does change. The slot address of the NOM module in must be provided in the upper byte of the first register of the routing path. The slot address is the physical position of the NOM module in the PLC mounting rack.

For example, if the NOM module is in slot 3 and the Jaguar is at node address 7, the MSTR command to read the Jaguar floating point registers for scale 1 and scale 2 is as follows:

Control Block

Register	Content	
40021	0002 Dec	Read command
40022	xxxx Hex	Error status
40023	0006 Dec	Number of registers to be read
40024	0020 Dec	Starting register for Jaguar status and floating point weight registers. (20 = 40020).
40025	0307 Hex	Routing path. NOM address = slot 3. Jaguar address = node 7.
40026	0001 Dec	Data slave routing path.
40027	0000 Dec	Additional routing register
40028	0000 Dec	Additional routing register
40029	0000 Dec	Additional routing register

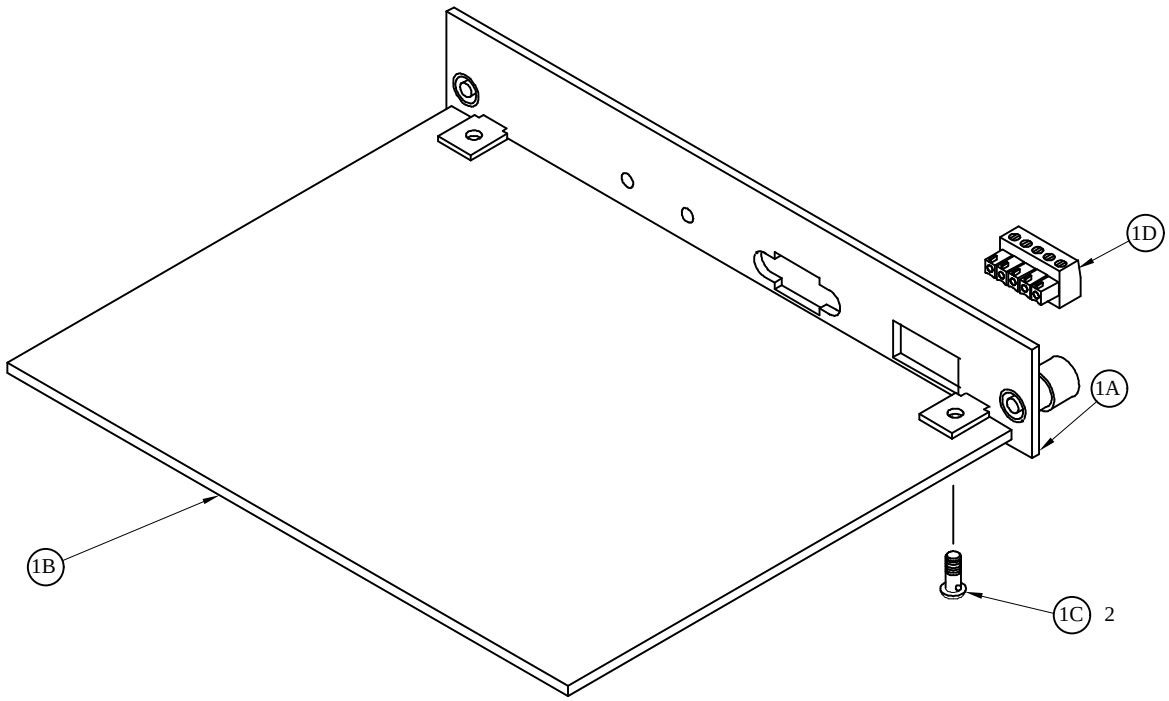
Data Area

Register	
40200	The PLC stores registers read from the Jaguar starting here.

Length

0006	This value defines the length of the Data Area.

Modbus Plus PCB Parts



Modbus Plus PCB Assembly

Ref #	Part Number	Description	QTY
1A	145478000A	I/O Plate	1
1B	15084900A	PCB, Modbus Plus (w/o Hardware)	1
1C	R0511100A	Screw, M4 X 10 Taptite	2
1D	14374900A	Connector, 5-Position Terminal Block	0**
*	14547700A	MODBUS PLUS PCB Panel Assembly	1

* Includes all parts listed above as an assembly.

** Included with Modbus Plus Pigtail Adapter 0900-0320.

5 Appendix 1

PLC Custom Interface

JagBasic applications use Shared Data to communicate custom fields with a PLC in floating point mode. There are unique Shared Data field names for Scale A and Scale B. Each status bit is one bit long. The floating point and string fields are each four bytes long. The PLC and the JagBasic application define the meaning of the fields. The Jaguar sends the PLC input fields designated as “Real-Time” to the PLC at every weight update. It sends or receives the other fields only when the PLC specifically requests them.

The input fields to the PLC from Scale A are:

/s_250	Unsigned Bit	Real-Time	PLC Custom Status 1 from Scale A
/s_251	Unsigned Bit	Real-Time	PLC Custom Status 2 from Scale A
/bas18	Floating Point	Real-Time	Custom Input 1 from Scale A to PLC
/bas19	4 Byte String	Real-Time	Custom Input 2 from Scale A to PLC
/bas20	Floating Point		Custom Input 3 from Scale A to PLC
/bas21	4 Byte String		Custom Input 4 from Scale A to PLC

The output fields from the PLC to Scale A are:

/bas14	Floating Point	Custom Output 1 to Scale A to PLC
/bas15	4 Byte String	Custom Output 2 to Scale A to PLC
/bas16	Floating Point	Custom Output 3 to Scale A to PLC
/bas17	4 Byte String	Custom Output 4 to Scale A to PLC

The input fields to the PLC from Scale B are:

/s_252	Unsigned Bit	Real-Time	PLC Custom Status 1 from Scale B
/s_253	Unsigned Bit	Real-Time	PLC Custom Status 2 from Scale B
/bas26	Floating Point	Real-Time	Custom Input 1 from Scale B to PLC
/bas27	4 Byte String	Real-Time	Custom Input 2 from Scale B to PLC
/bas28	Floating Point		Custom Input 3 from Scale B to PLC
/bas29	4 Byte String		Custom Input 4 from Scale B to PLC

The output fields from the PLC to Scale B are:

/bas22	Floating Point	Custom Output 1 to Scale B from PLC
/bas23	4 Byte String	Custom Output 2 to Scale B from PLC
/bas24	Floating Point	Custom Output 3 to Scale B from PLC
/bas25	4 Byte String	Custom Output 4 to Scale B from PLC

JagBasic to Analog Output Shared Data Interface

JagBasic variables may be used as sources for channel 1, or channel 2, or both channels. The JagBasic variable for channel 1 is floating point variable /bas18. The JagBasic source variable for channel 2 is floating point variable /bas20. JagBasic may be used as a source for one channel and scale source for the other channel.

You must enter the zero and span preset values for the JagBasic sources in the <Config Options> <Analog Output> setup menus. You can also trim the zero and span values for the JagBasic sources, but the value that you are trimming must be set by a JagBasic command before entering setup. This allows you to "calibrate" the Analog Output card.

For example, if you wish to trim the span value for a JagBasic source for channel 2, you must enter the span value into /bas20. Then you can enter setup and use the Analog Output setup menu to trim the span value.

Appendix 2

Sample Conversion of IEEE Floating Point Format into Siemens S5 Floating Point Format

This is a sample S5 PLC routine for converting an IEEE Floating Point Number to a Siemens S5 PLC Floating Point Number,

IEEE-Format

bit 31 Sign of the mantissa

bits 30-23 Value of the exponent+127. To determine value of the exponent, 127 must be deducted.

bits 22-0 Mantissa. Value of the fraction g. Only the fraction g is stored instead of 1+g.

Example: Instead of the value 1.2345 only .2345 is stored in the mantissa.

S5-Format

bits 31-24 Value of the exponent in 2's complement.

bits 23-0 Value of the fraction g in 2's complement. In S5-format, g is stored.

When in S5-format, the value of the mantissa does not consist of 1+g. Something must be computed since the value of g in the S5-format must always be less than 1.

Solution:

The value of the IEEE mantissa will be divided by 2 to make it less than 1. Consequently, the value of the exponent will be increased by 1.

(1 + gIEEE) / 2 = 0.5 + gIEEE / 2 = gS5

The fraction gS5 of the S5-mantissa will be calculated from the formula above.

Implementation:

The addend gIEEE/2 is implemented by shifting the IEEE mantissa one place to the right

The addend 0.5 is implemented by setting bit 22 in the S5 mantissa.

And now that the mantissa has been divided by 2 the exponent must be increased by 1.

For formatting, do the following.

127 must be subtracted from the IEEE exponent

The IEEE exponent must be shifted to the appropriate position in the S5-format

Based on the description of the mantissa as 1 + g, whereby only g is stored, the value of the exponent in S5-format must be incremented by 1.

If the sign of the IEEE mantissa is set to 1, the 2's complement must be created.

Description of the functional building blocks:

The to-be-converted IEEE floating point value must be placed in MD 200

The converted S5 floating point value can be fetched from MD 220

Sample S5 Code:

```
Name    :S7INS5
  :L    MW 200    START
  :SVD       7    IEEE EXPONENT TO BYTE 0 IN ACCUMULATOR
  :L    KF +126
  :-F             EXPONENT IS NOW IN S5 FORMAT
  :T    MB 230    EXPONENT IS STORED IN MB 230
  :
  :               CALCULATE MANTISSA
  :L    MD 200
  :SVD       1    SHIFT BY 1 TO THE RIGHT
  :T    MW 222    STORE BYTES 3&4 IN MW 222
  :SVD      16    BYTE  2 TO 4 IN ACCUMULATOR
  :L    KH 003F   SET BITS 6&7 TO 0
  :UW
  :L    KH 0040   SET BIT 6 TO 1
  :OW             ALL OTHER BITS REMAIN
  :T    MB 221    STORE IN MB 221
  :
  :L    MB 200    MANTISSA IS CHECKED FOR SIGN
  :L    KH 80
  :<=G
  :SPB  =EXP      IF POSITIVE, THEN OK
  :
  :L    MD 220    IF NEGATIVE, DETERMINE 2'S COMPLEMENT
  :KZD
  :T    MD 220
  :
EXP:L   MB 230    EXPONENT CORRECTLY PLACED
  :T    MB 220
  :L    MD 220
  :BE
```

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Publication Part Number: A14884200A **Publication Date:** 1/98

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