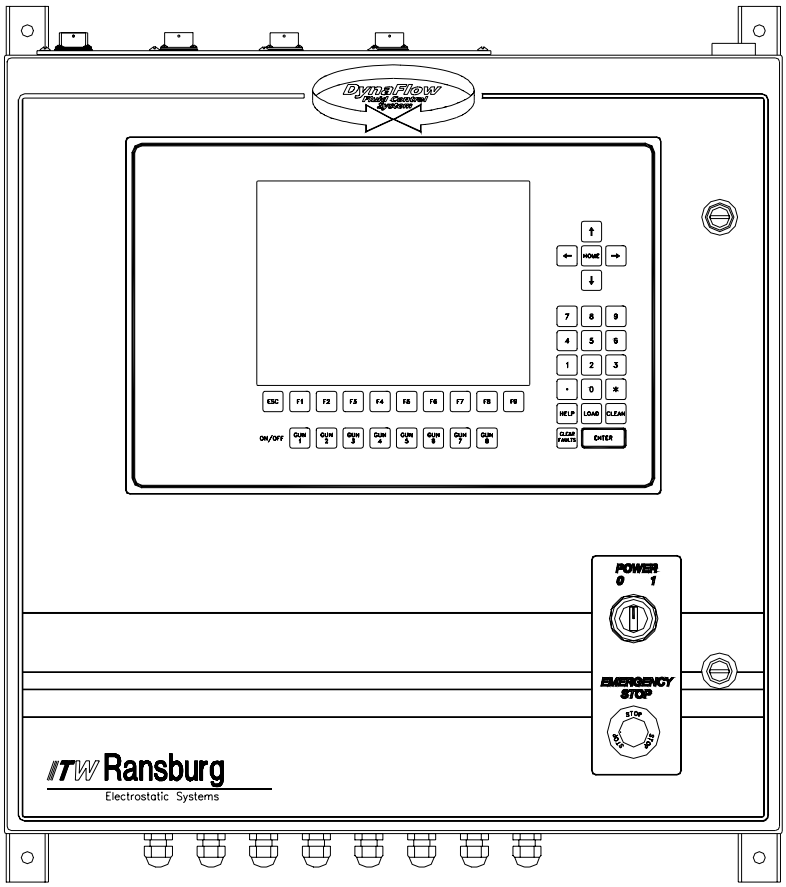
ITW Ransburg
Electrostatic Systems

SERVICE MANUAL
LN-9406-00.2
(Replaces LN-9246-00.1)

DYNAFLOW™ PROGRAMER'S MANUAL



MODEL: 77376

IMPORTANT: Before using this equipment, carefully read SAFETY PRECAUTIONS, starting on page 1, and all instructions in this manual. Keep this Service Manual for future reference.

Service Manual Price: $ 50.00 (U.S.)

NOTE: This manual has been changed from LN-9406-00.1 to revison LN-9406-00.2. Reasons for this change are noted under "Manual Change Summary" inside the back cover of this manual.

CONTENTS

	PAGE
SAFETY:	**1-3**
SAFETY PRECAUTIONS	1
HAZARDS / SAFEGUARDS	2-3
INTRODUCTION:	**4-42**
DESCRIPTION	4
ALLEN BRADLEY REMOTE I/O (RIO)	5
RIO PROTOCOL	5
RIO DISCRETE I/O	5
RIO Starting Quarter	6
System I/O - PLC Word O	6
Channel I/O - PLC Words 1 to 4	7
RIO BLOCK TRANSFERS (BTR & BTW)	7-8
Null Data - Type 00	8
Operational Data - Type 01	8-10
Gun Configuration - Type 02	11-12
Job Table - Type 03	113
System Configuration - Type 04	14
Flow Totals - Type 05	15-16
Alarms Table - Type 06	16-21
Calibration Table - Type 07	22
CALIBRATION PROCEDURES FOR RIO	23
Normal Calibration	23
Lookup Table Population	23
Lookup Tables - Type 08	24
ITW RANSBURG HOST SIO	25
SIO Operation	25
SIO Protocol	26-42
INSTALLATION:	**43-47**
RIO Hardware Setting	43
RIO Rack Address	43-45
RIO Rack Size	46
RIO Starting Quarter	46
RIO Baud Rate	46
RIO Non-Used Switch Settings	46
RIO Cable Connections	47
SIO Hardware Settings	47
SIO Port Configuration	47
SIO Baud Rate	47
SIO Driver Levels	47
SIO Cable Connection	47

PAGE

WARRANTY POLICIES: 49

LIMITED WARRANTY..... 49

APPENDIX: 50-53

PAINT AND SOLVENT SPECIFICATIONS..... 50
VISCOSITY CONVERSION CHART..... 51-52
VOLUMETRIC CONTENT OF HOSE OR TUBE..... 53

NOTES

SAFETY

SAFETY PRECAUTIONS

Before operating, maintaining or servicing any ITW Ransburg system, read and understand all of the technical and safety literature for your ITW Ransburg products. This manual contains information that is important for you to know and understand. This information relates to USER SAFETY and PREVENTING EQUIPMENT PROBLEMS. To help you recognize this information, we use the following symbols. Please pay particular attention to these sections.

A WARNING! states information to alert you to a situation that might cause serious injury if instructions are not followed.

A CAUTION! states information that tells how to prevent damage to equipment or how to avoid a situation that might cause minor injury.

A NOTE is information relevant to the procedure in progress.

While this manual lists standard specifications and service procedures, some minor deviations may be found between this literature and your equipment. Differences in local codes and plant requirements, material delivery requirements, etc., make such variations inevitable. Compare this manual with your system installation drawings and appropriate ITW Ransburg equipment manuals to reconcile such differences.

Careful study and continued use of this manual will provide a better understanding of the equipment and process, resulting in more efficient operation, longer trouble-free service and faster, easier troubleshooting. If you do not have the manuals and safety literature for your ITW Ransburg system, contact your local ITW Ransburg representative or ITW Ransburg.

⚠ WARNING

► The user **MUST** read and be familiar with the Safety Section in this manual and the ITW Ransburg safety literature therein identified.

► This manual **MUST** be read and thoroughly understood by **ALL** personnel who operate, clean or maintain this equipment! Special care should be taken to ensure that the **WARNINGS** and safety requirements for operating and servicing the equipment are followed. The user should be aware of and adhere to **ALL** local building and fire codes and ordinances as well as **NFPA 33 SAFETY STANDARD,** prior to installing, operating, and/or servicing this equipment.

⚠ WARNING

► The hazards shown on the following page may occur during the normal use of this equipment. Please read the hazard chart beginning on page 2.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
Spray Area 	Fire Hazard Improper or inadequate operation and maintenance procedures will cause a fire hazard. Protection against inadvertent arcing that is capable of causing fire or explosion is lost if any safety interlocks are disabled during operation. Frequent power supply shutdown indicates a problem in the system requiring correction.	Fire extinguishing equipment must be present in the spray area and tested periodically. Spray areas must be kept clean to prevent the accumulation of combustible residues. Smoking must never be allowed in the spray area. The high voltage supplied to the atomizer must be turned off prior to cleaning, flushing or maintenance. When using solvents for cleaning: Those used for equipment flushing should have flash points equal to or higher than those of the coating material. Those used for general cleaning must have flash points above 100°F (37.8°C). Spray booth ventilation must be kept at the rates required by NFPA-33, OSHA, and local codes. In addition, ventilation must be maintained during cleaning operations using flammable or combustible solvents. Electrostatic arcing must be prevented. Test only in areas free of combustible material. Testing may require high voltage to be on, but only as instructed. Non-factory replacement parts or unauthorized equipment modifications may cause fire or injury. If used, the key switch bypass is intended for use only during setup operations. Production should never be done with safety interlocks disabled. Never use equipment intended for use in waterborne installations to spray solvent based materials. The paint process and equipment should be set up and operated in accordance with NFPA-33, NEC, and OSHA requirements.
General Use and Maintenance 	Improper operation or maintenance may create a hazard. Personnel must be properly trained in the use of this equipment.	Personnel must be given training in accordance with the requirements of NFPA-33. Instructions and safety precautions must be read and understood prior to using this equipment. Comply with appropriate local, state, and national codes governing ventilation, fire protection, operation maintenance, and housekeeping. Reference OSHA, NFPA 33, and your insurance company requirements.

AREA Tells where hazards may occur.	**HAZARD** Tells what the hazard is.	**SAFEGUARDS** Tells how to avoid the hazard.
Electrical Equipment 	High voltage equipment is utilized. Arcing in areas of flammable or combustible materials may occur. Personnel are exposed to high voltage during operation and maintenance. Protection against inadvertent arcing that may cause a fire or explosion is lost if safety circuits are disabled during operation. Frequent power supply shut-down indicates a problem in the system which requires correction. An electrical arc can ignite coating materials and cause a fire or explosion.	The power supply, optional remote control cabinet, and all other electrical equipment must be located outside Class I or II, Division 1 and 2 hazardous areas. Refer to NFPA-33. Turn the power supply OFF before working on the equipment. Test only in areas free of flammable or combustible material. Testing may require high voltage to be on, but only as instructed. Production should never be done with the safety circuits disabled. Before turning the high voltage on, make sure no objects are within the sparking distance.
Explosion Hazard/ Incompatible Materials 	Halogenated hydrocarbon solvents for example: methylene chloride and 1,1,1,-Trichloroethane are not chemically compatible with the aluminum that might be used in many system components. The chemical reaction caused by these solvents reacting with aluminum can become violent and lead to an equipment explosion.	Aluminum is widely used in other spray application equipment - such as material pumps, regulators, triggering valves, etc. Halogenated hydrocarbon solvents must never be used with aluminum equipment during spraying, flushing, or cleaning. Read the label or data sheet for the material you intend to spray. If in doubt as to whether or not a coating or cleaning material is compatible, contact your material supplier. Any other type of solvent may be used with aluminum equipment.
Toxic Substances 	Certain material may be harmful if inhaled, or if there is contact with the skin.	Follow the requirements of the Material Safety Data Sheet supplied by coating material manufacturer. Adequate exhaust must be provided to keep the air free of accumulations of toxic materials. Use a mask or respirator whenever there is a chance of inhaling sprayed materials. The mask must be compatible with the material being spray-ed and its concentration. Equipment must be as prescribed by an industrial hygienist or safety expert, and be NIOSH approved.

INTRODUCTION

DESCRIPTION

The ***DynaFlow™ System*** is capable of communicating with remote host computers or Allen Bradley PLC's via the Interface Module. The Interface Module supports three (3) serial ports. Two of these ports can be used to communicate with remote hosts.

The first port is reserved for debugging purposes and is not used for communicating with remote hosts.

The second port is called the Serial I/O, or SIO, port. It may be used to communicate with a remote host computer using either RS-232C or RS-422. This port may also be connected to an Ethernet terminal server to allow communications over 10/100 Base-T connections using either TCP/IP sockets or as a COM port on a Windows-based PC using a special device driver.

The third port is called the Remote I/O, or RIO, port. It may be used to communicate with any PLC that supports Allen-Bradley's Remote I/O (RIO) protocol.

All three of the communication channels may be in use at the same time. However, data written to the Interface Module from one channel is not passed to the other channels. Any host computer connected to a channel is responsible for reading data from the Interface Module in order to stay current with the data within the Interface Module. The Interface Module is the master source of all DynaFlow data. Host computers must read-modify-write data stored in the Interface Module.

NOTE

► The flow control parameters and job specific parameters required for each fluid is referred to by differenct names depending on operator preferences and installation requirements. Color Table, Job, P-Set, and Recipe all mean the same thing. The term Job will be used in this manual. The term Gun in this manual refers to any applicator such as a bell, gun, or disk. A Gun can be single-component or dual-component.

ALLEN-BRADLEY REMOTE I/O (RIO)

RIO Operation

The RIO interface contains a proprietary Allen-Bradley application specific IC (ASIC) that is licensed to ITW Ransburg. This ASIC formats the information to and from the RIO link.

RIO PROTOCOL

The DynaFlow Interface Module communicates with Allen-Bradley PLC's using remote I/O protocol. Two types of data are supported:

1. Discrete I/O
2. Block Transfers

RIO DISCRETE I/O

There are five (5) words of discrete inputs and five (5) words of discrete outputs possible for each DynaFlow Interface Module. Each DynaFlow Interface Module supports up to four (4) Channel Cards and each Channel Card has two (2) Channels for a total of eight (8) Channels. The PLC discrete I/O RIO output bits are logical OR'd with the discrete I/O hard-wired signals so that either hard-wired signals or PLC control signals may control the system. Likewise, the DynaFlow hard-wired outputs are sent to the PLC via the discrete I/O RIO inputs.

The DynaFlow System uses two-slot addressing and appears to a PLC as a collection of 8-bit modules of I/O. In other words, each module has 8 inputs and 8 outputs. The Interface Module appears as a single 8-bit I/O module in slot 1, or the odd slot of a pair of slots. Therefore, the Interface Module, which reports the System I/O signals, uses the high byte of word 0.

Each DynaFlow Channel Card appears as two 8-bit I/O modules. The first channel appears in the low byte and the second channel appears in the high byte of each successive word in the RIO discrete I/O space.

The following table describes the RIO signals with their respective bit locations in the discrete I/O RIO words.

The following table describes the RIO signals with their respective bit locations in the discrete I/O RIO words.

RIO Starting Quarter

STARTING QUARTER				
I/O Group	**Ø**	**1**	**2**	**3**
0	Interface Module			
1	Channel Card #1			
2	Channel Card #2	Interface Module		
3	Channel Card #3	Channel Card #1		
4	Channel Card #4	Channel Card #2	Interface Module	
5		Channel Card #3	Channel Card #1	
6		Channel Card #4	Channel Card #2	Interface Module
7			Channel Card #3	Channel Card #1

The following tables describe the RIO signals with their respective bit locations in the discrete I/O words.

System I/O - PLC Word 0

PLC WORD O		
Bit #	**Inputs**	**Outputs**
0	Reserved	Reserved
1	Reserved	Reserved
2	Reserved	Reserved
3	Reserved	Reserved
4	Reserved	Reserved
5	Reserved	Reserved
6	Reserved	Reserved
7	Reserved	Reserved
8	System Pulse	System Halt
9	System Fault	Fault Reset
10	System Spare	Global Gun Enable
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

CHANNEL I/O - PLC WORDS 1 TO 4

PLC WORDS 1 TO 4						
Bit #	**Inputs**	**Outputs**	**Word 1**	**Word 2**	**Word 3**	**Word 4**
0	Ready	Trigger	Ch. 1	Ch. 3	Ch. 5	Ch. 7
1	Active	Run	Ch. 1	Ch. 3	Ch. 5	Ch. 7
2	Fault	Transparent/ Open-Loop	Ch. 1	Ch. 3	Ch. 5	Ch. 7
3	Pot Life Alarm	Total Hold	Ch. 1	Ch. 3	Ch. 5	Ch. 7
4	Clean	Halt	Ch. 1	Ch. 3	Ch. 5	Ch. 7
5	Load	Total Reset	Ch. 1	Ch. 3	Ch. 5	Ch. 7
6	Calibrate	Clean	Ch. 1	Ch. 3	Ch. 5	Ch. 7
7	MVR Enable	Load	Ch. 1	Ch. 3	Ch. 5	Ch. 7
8	Ready	Trigger	Ch. 2	Ch. 4	Ch. 6	Ch. 8
9	Active	Run	Ch. 2	Ch. 4	Ch. 6	Ch. 8
10	Fault	Transparent/ Open-Loop	Ch. 2	Ch. 4	Ch. 6	Ch. 8
11	Pot Life Alarm	Total Hold	Ch. 2	Ch. 4	Ch. 6	Ch. 8
12	Clean	Halt	Ch. 2	Ch. 4	Ch. 6	Ch. 8
13	Load	Total Reset	Ch. 2	Ch. 4	Ch. 6	Ch. 8
14	Calibrate	Clean	Ch. 2	Ch. 4	Ch. 6	Ch. 8
15	MVR Enable	Load	Ch. 2	Ch. 4	Ch. 6	Ch. 8

RIO BLOCK TRANSFERS (BTR & BTW)

All DynaFlow parameters, configurations, and operational data can be transferred between the DynaFlow Interface Module and a PLC via the RIO communication link using Block Transfer Read and Block Transfer Write. Each type of data uses a unique structure for the block transfer. The description of the data parameters can be referenced in the most current ***DynaFlow User's Manual*** and the ***DynaFlow Operator Interface Manual*** with the exception of the differences that exist with RIO operation.

RIO BLOCK TRANSFER TYPES			
Type	**Description**	**BTR Length**	**BTW Length**
00	Null Data	4	4
01	Operational Data	58	20
02	Gun Configuration Data	20	20
03	Job Table Data	25	25
04	System Configuration Data	15	13
05	Flow Totals	23	5
06	Alarms	12	4
07	Calibration Control & Data	11	8
08	Lookup Table Data	24	24

NOTE

► The BTW and BTR commands issued by the PLC must be issued for the exact number of words required.

The System Configuration and Gun Configuration data must be sent first to the DynaFlow Interface Module when the system is powered up, or commissioned for the first time. The Job Table data must then be sent for each Job for each Gun. The configuration and flow totals data are stored in non-volatile memory in the DynaFlow Interface Module and therefore do not need to be sent after a power cycle unless only to "Refresh" the information to be certain of its content.

All gun, channel, and job numbers are sent as one-based values. In other words, gun or channel numbers are sent as 1 to 8 and job numbers are sent as 1 to 100.

Null Data - Type 00

A BTW must always precede a BTR in order to inform the DynaFlow Interface Module what data is to be returned in the next BTR. Null BTW commands can be used when no data must be sent prior to the next BTR. If the next BTR Type does not require a Gun # or Channel # and/or Job #, those fields may be zero. Otherwise, the Next BTR Type, Gun # or Channel # and Job # specify the appropriate data to be returned in the next BTR.

NULL DATA - TYPE 00		
	BTW	
Word	Description	Units/ Value
0	BTW Type	00
1	Next BTR Type	00, or 01 to 08
2	Next BTR Gun # or Channel #	0, or 1 to 8
3	Next BTR Job #	0, or 1 to 100

Operational Data - Type 01

RIO Operational Data block transfers are used for normal process control while painting parts. This assumes the system and applicators have been initially configured.

The gun job numbers and set points may be specified as zero if no change is desired for a gun. However, if a set point is specified as non-zero, a valid job number must be specified.

In PID Mode, the set point is cc/minute.

In Transparent Mode, the Gun Set Point represents a 0 to 100% request that is passed directly to the analog output. For 2K operation, the lower byte is the % resin and the upper byte is the % catalyst, where 0 to 255 reperesents 0% to 100%.

In Open Loop mode (Transparent mode with DIP switch 3 up on the Channel Card), the set point value is used directly as a cc/minute set point to use for picking an output value from the Lookup Table.

Operational Data – Type 01					
	BTR		BTW		
Word	Description	Units/Value	Description	Units/Value	
0	Previous BTW Type	00 to 08	BTW Type	01	
1	BTR Type	01	Next BTR Type	00, or 01 to 08	
2	Gun #1 Job #	1 to 100	Next BTR Gun #	0, or 1 to 8	
3	Gun #2 Job #	1 to 100	Next BTR Job #	0, or 1 to 100	
4	Gun #3 Job #	1 to 100	Gun #1 Job #	0, or 1 to 100	
5	Gun #4 Job #	1 to 100	Gun #1 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte
6	Gun #5 Job #	1 to 100	Gun #2 Job #	0, or 1 to 100	
7	Gun #6 Job #	1 to 100	Gun #2 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte
8	Gun #7 Job #	1 to 100	Gun #3 Job #	0, or 1 to 100	
9	Gun #8 Job #	1 to 100	Gun #3 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte
10	Gun #1 Actual Ratio	Ratio x 100	Gun #4 Job #	0, or 1 to 100	
11	Gun #2 Actual Ratio	Ratio x 100	Gun #4 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte
12	Gun #3 Actual Ratio	Ratio x 100	Gun #5 Job #	0, or 1 to 100	
13	Gun #4 Actual Ratio	Ratio x 100	Gun #5 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte
14	Gun #5 Actual Ratio	Ratio x 100	Gun #6 Job #	0, or 1 to 100	
15	Gun #6 Actual Ratio	Ratio x 100	Gun #6 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte
16	Gun #7 Actual Ratio	Ratio x 100	Gun #7 Job #	0, or 1 to 100	
17	Gun #8 Actual Ratio	Ratio x 100	Gun #7 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte
18	Channel #1 Set Point	CC/min	Gun #8 Job #	0, or 1 to 100	
19	Channel #1 Actual Flow Rate	CC/min	Gun #8 Set Point	CC/min for Gun	0 to 255 for Master DAC in low byte
					0 to 255 for Slave in high byte

Operational Data – Type 01					
	BTR		BTW		
Word	Description	Units/Value	Description	Units/Value	
20	Channel #1 Analog Output	0 to 255			
21	Channel #1 Current Job Daily Total	Liters			
22		CC's			
23	Channel #2 Set Point	CC/min			
24	Channel #2 Actual Flow Rate	CC/min			
25	Channel #2 Analog Output	0 to 255			
26	Channel #2 Current Job Daily Total	Liters			
27		CC's			
28	Channel #3 Set Point	CC/min			
29	Channel #3 Actual Flow Rate	CC/min			
30	Channel #3 Analog Output	0 to 255			
31	Channel #3 Current Job Daily Total	Liters			
32		CC's			
33	Channel #4 Set Point	CC/min			
34	Channel #4 Actual Flow Rate	CC/min			
35	Channel #4 Analog Output	0 to 255			
36	Channel #4 Current Job Daily Total	Liters			
37		CC's			
38	Channel #5 Set Point	CC/min			
39	Channel #5 Actual Flow Rate	CC/min			
40	Channel #5 Analog Output	0 to 255			
41	Channel #5 Current Job Daily Total	Liters			
42		CC's			
43	Channel #6 Set Point	CC/min			
44	Channel #6 Actual Flow Rate	CC/min			
45	Channel #6 Analog Output	0 to 255			
46	Channel #6 Current Job Daily Total	Liters			
47		CC's			
48	Channel #7 Set Point	CC/min			
49	Channel #7 Actual Flow Rate	CC/min			
50	Channel #7 Analog Output	0 to 255			
51	Channel #7 Current Job Daily Total	Liters			
52		CC's			
53	Channel #8 Set Point	CC/min			
54	Channel #8 Actual Flow Rate	CC/min			
55	Channel #8 Analog Output	0 to 255			
56	Channel #8 Current Job Daily Total	Liters			
57		CC's			

Gun Configuration - Type 02

RIO Gun Configuration Block transfers are typically required when configuring a gun for the first time or periodically adjusting parameters.

Gun Configuration - Type 02				
	BTR		BTW	
Word	Description	Units/Value	Description	Units/Value
0	Previous BTW Type	00 to 08	BTW Type	02
1	BTR Type	02	Next BTR Type	00, or 01 to 08
2	Gun #	1 to 8	Gun # and Next BTR Gun #	1 to 8
3	Mode	0 = Automatic 1 = Manual 2 = Undefined	Next BTR Job #	1 to 100
4	Number of Channels	1 to 2	Mode	0 = Automatic 1= Manual 2 = Undefined
5	Master Channel #	1 to 8	Number of Channels	1 to 2
6	Slave Channel #	1 to 8	Master Channel #	1 to 8
7	Flow Tolerance Time	0.1 seconds	Slave Channel #	1 to 8
8	Clean Channels	Bit field	Flow Tolerance Time	0.1 seconds
9	Default Job #	1 to 100	Clean Channels	Bit Field
10	Flow Tolerance Percentage	0 to 100	Default Job #	Bit Field
11	Mixed Volume	CC	Flow Tolerance Percentage	0 to 100
12	Tolerance Volume	CC	Mixed Volume	CC
13	Trigger Off Delay	0.1 seconds	Tolerance Volume	CC
14	Trigger On Delay	0.1 seconds	Trigger Off Delay	0.1 seconds
15	Reverse Flow Allowed	CC	Trigger On Delay	0.1 seconds
16	Master Channel Regulator Type	Bit Field	Reverse Flow Allowed	CC
17	Slave Channel Regulator Type	Bit Field	Master Channel Regulator Type	Bit Field
18	Tolerance Volume Time (Not Used)	0.1 seconds	Slave Channel Regulator Type	Bit Field
19			Tolerance Volume Time (Not Used)	0.1 seconds

Channel Regulator Types are passed as a bit field where each of sixteen (16) possible types has a value of a binary power of two. Thus only one bit should be set at any time.

Bit	Reset Selected Total	Decimal Value	Hex Value
0	DR1 1:1	1	0x0001
1	DR1 1:2	2	0x0002
2	DR1 1:3	4	0x0004
3	DR1 1:4	8	0x0008
4	DR1 1:5	16	0x0010
5	DR1 1:6	32	0x1120
6	DR1 1:8	64	0x0040
7	DR1 1:10	64	0x0080
8	MVR #2	256	0x0100
9	MVR #3	512	0x0200
10	MVR #4	1,024	0x0400
11	Other	2,048	0x0800
12	Reserved	4,096	0x1000
13	Reserved	8,192	0x2000
14	Reserved	16,384	0x4000
15	Reserved	32,768	0x8000

Clean Channels are passed as a bit field with only two bits presently defined. Both bits may be set.

Bit	Reset Selected Total	Decimal Value	Hex Value
0	Master	1	0x0001
1	Slave	2	0x0002
2	Reserved	4	0x0004
3	Reserved	8	0x0008
4	Reserved	16	0x0010
5	Reserved	32	0x1120
6	Reserved	64	0x0040
7	Reserved	64	0x0080
8	Reserved	256	0x0100
9	Reserved	512	0x0200
10	Reserved	1,024	0x0400
11	Reserved	2,048	0x0800
12	Reserved	4,096	0x1000
13	Reserved	8,192	0x2000
14	Reserved	16,384	0x4000
15	Reserved	32,768	0x8000

Job Table - Type 03

RIO Job Table Block Transfers are typically required when configuring a Gun for the first time or periodically adjusting parameters.

JOB TABLE - Type 03				
	BTR		BTW	
Word	Description	Units/Value	Description	Units/Value
0	Previous BTW Type	00 to 08	BTW Type	03
1	BTR Type	3	Next BTR Type	00, or 01 to 08
2	Gun #	1 to 8	Gun # and Next BTR Gun #	1 to 8
3	Job #	1 to 100	Job # and Next BTR Job #	1 to 100
4	Ratio (Parts Master to 1 Part Slave)	Ratio x 100	Ratio (Parts Master to 1 Part Slave)	Ratio x 100
5	Flow Set Point	CC/min	Flow Set Point	CC/min
6	Maximum Flow Rate	CC/min	Maximum Flow Rate	CC/min
7	Minimum Flow Rate	CC/min	Minimum Flow Rate	CC/min
8	Pot Life Timer	seconds	Pot Life Timer	seconds
9	Master MVR High	0 to 100 PSIG	Master MVR High	0 to 100 PSIG
10	Master MVR Low	0 to 100 PSIG	Master MVR Low	0 to 100 PSIG
11	Master Pulses Per Liter	PPL % 10,000	Master Pulses Per Liter	PPL % 10,000
12		PPL / 10,000		PPL / 10,000
13	Master PID Dead Band	CC/min	Master PID Dead Band	CC/min
14	Master PID Proportional Gain		Master PID Proportional Gain	
15	Master PID Integral Gain		Master PID Integral Gain	
16	Master PID Derivative Gain		Master PID Derivative Gain	
17	Slave MVR High	0 to 100 PSIG	Slave MVR High	0 to 100 PSIG
18	Slave MVR Low	0 to 100 PSIG	Slave MVR Low	0 to 100 PSIG
19	Slave Pulses Per Liter	PPL % 10,000	Slave Pulses Per Liter	PPL % 10,000
20		PPL / 10,000		PPL / 10,000
21	Slave PID Dead Band	CC/min	Slave PID Dead Band	CC/min
22	Slave PID Proportional Gain		Slave PID Proportional Gain	
23	Slave PID Integral Gain		Slave PID Integral Gain	
24	Slave PID Derivative Gain		Slave PID Derivative Gain	

NOTE: When a GUN is configured for single-component operation, the Slave data is not used and will be ignored for BTW commands and returned as zeros for BTR commands.

System Configuration - Type 04

SYSTEM CONFIGURATION - Type 04				
	BTR		BTW	
Word	Description	Units/Value	Description	Units/Value
0	Previous BTW Type	00 to 08	BTW Type	04
1	BTR Type	4	Next BTR Type	00, or 01 to 08
2	Horn Code	0 to 7	Next BTR Gun # or Channel #	0, or 1 to 8
3	Blow Off time	0 to 255 seconds	Next BTR Job #	0, or 1 to 100
4	Interface SW1 (low) & SW2 (high)	Hexadecimal	Horn Code	0 to 7
5	Channel Cards 1 (low) & 2 (high) DIP SW1	CC/min	Blow Off Time	0 to 255 seconds
6	Channel Cards 3 (low) & 4 (high) DIP SW1	Hexadecimal	Reserved	0
7	Interface Version	Hexadecimal	Reserved	0
8	Password (high word)	0 to 99,900	Reserved	0
9	Channel #6 Actual Flow Rate		Reserved	0
10	Password Timer	0 to 255 minutes	Password (low word)	0 to 99,999
11	Channel Card 1 Version	Hexadecimal	Password (high word)	
12	Channel Card 2 Version	Hexadecimal	Password Timer	0 to 255 minutes
13	Channel Card 3 Version	Hexadecimal		
14	Channel Card 4 Version	Hexadecimal		

Flow Totals - Type 05

RIO Flow Totals block transfers are used to read or reset accumulated flow totals during normal operation.

FLOW TOTALS - Type 05				
	BTR		BTW	
Word	Description	Units/Value	Description	Units/Value
0	Previous BTW Type	00 to 08	BTW Type	05
1	BTR Type	05	Next BTR Type	00, or 01 to 08
2	Channel #	1 to 8	Channel # and Next BTR Channel #	1 to 8
3	Daily Total for Selected Job	Liters	Job # and Next BTR Job #	1 to 100
4		CC's	Reset Selected	Bit Field
5	YTD Total for Selected Job	Liters		
6		CC's		
7	Calibrate Total for Selected Job	Liters		
8		CC's		
9	Grand Total for Selected Job	Liters		
10		CC's		
11	Daily Total for All Jobs	Liters		
12		CC's		
13	YTD Total for All Jobs	Liters		
14		CC's		
15	Calibrate Total for All Jobs	Liters		
16		CC's		
17	Grand Total for All Jobs	Liters		
18		CC's		
19	Clean Total for All Jobs	Liters		
20		CC's		
21	Sum of ABS (Error) for Selected Job	Liters		
22		CC's		

The Reset Selected bit field is defined as follows:

Bit	Reset Selected Total	Decimal Value	Hex Value
0	Daily Total for selected Job	1	0x0001
1	YTD Total for Selected Job	2	0x0002
2	Calibrate Total for Selected Job	4	0x0004
3	Grand Total for Selected Job	8	0x0008
4	Daily Total for All Jobs	16	0x0010
5	YTD Total for All Jobs	32	0x1120
6	Calibrate Total for All Jobs	64	0x0040
7	Grand Total for All Jobs	64	0x0080
8	Clean Total for All Jobs	256	0x0100
9	Reserved	512	0x0200
10	Reserved	1,024	0x0400
11	Reserved	2,048	0x0800
12	Reserved	4,096	0x1000
13	Reserved	8,192	0x2000
14	Reserved	16,384	0x4000
15	Reserved	32,768	0x8000

Alarm Table - Type 06

RIO Alarms block transfers are used to read the log of the past ten (10) faults recorded by the DynaFlow Interface Module. The BTW has no effect on the system and may be used to schedule the next block transfer.

ALARM TOTALS - Type 06				
	BTR		BTW	
Word	Description	Units/Value	Description	Units/Value
0	Previous BTW Type	0	BTW Type	00
1	BTR Type	06	Next BTR Type	06
2	Alarm Word 1	Bit Field	Next BTR Gun #	00
3	Alarm Word 2	Bit Field	Next BTR Job #	00
4	Alarm Word 3	Bit Field		
5	Alarm Word 4	Bit Field		
6	Alarm Word 5	Bit Field		
7	Alarm Word 6	Bit Field		
8	Alarm Word 7	Bit Field		
9	Alarm Word 8	Bit Field		
10	Alarm Word 9	Bit Field		
11	Alarm Word 10	Bit Field		

The Active Alarm bit fields are defined as follows:

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
1	0	Gun #1 Pot Life Exceeded	1	0x0001
1	1	Gun #2 Pot Life Exceeded	2	0x0002
1	2	Gun #3 Pot Life Exceeded	4	0x0004
1	3	Gun #4 Pot Life Exceeded	8	0x0008
1	4	Gun #5 Pot Life Exceeded	16	0x0010
1	5	Gun #6 Pot Life Exceeded	32	0x1120
1	6	Gun #7 Pot Life Exceeded	64	0x0040
1	7	Gun #8 Pot Life Exceeded	64	0x0080
1	8	Reserved	256	0x0100
1	9	Reserved	512	0x0200
1	10	Reserved	1,024	0x0400
1	11	Reserved	2,048	0x0800
1	12	Reserved	4,096	0x1000
1	13	Reserved	8,192	0x2000
1	14	Reserved	16,384	0x4000
1	15	Reserved	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
2	0	Bad Communication Link	1	0x0001
2	1	Reserved	2	0x0002
2	2	Reserved	4	0x0004
2	3	Reserved	8	0x0008
2	4	Reserved	16	0x0010
2	5	Reserved	32	0x1120
2	6	Reserved	64	0x0040
2	7	Reserved	64	0x0080
2	8	Disk Write Protect	256	0x0100
2	9	Bad Disk	512	0x0200
2	10	Disk Not Ready	1,024	0x0400
2	11	Disk Write Error	2,048	0x0800
2	12	Disk Read Error	4,096	0x1000
2	13	Missing File	8,192	0x2000
2	14	Reserved	16,384	0x4000
2	15	Reserved	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
3	0	Channel #1 Out of Tolerance	1	0x0001
3	1	Channel #2 Out of Tolerance	2	0x0002
3	2	Channel #3 Out of Tolerance	4	0x0004
3	3	Channel #4 Out of Tolerance	8	0x0008
3	4	Channel #5 Out of Tolerance	16	0x0010
3	5	Channel #6 Out of Tolerance	32	0x1120
3	6	Channel #7 Out of Tolerance	64	0x0040
3	7	Channel #8 Out of Tolerance	64	0x0080
3	8	Channel #1 Reverse Flow Limit	256	0x0100
3	9	Channel #2 Reverse Flow Limit	512	0x0200
3	10	Channel #3 Reverse Flow Limit	1,024	0x0400
3	11	Channel #4 Reverse Flow Limit	2,048	0x0800
3	12	Channel #5 Reverse Flow Limit	4,096	0x1000
3	13	Channel #6 Reverse Flow Limit	8,192	0x2000
3	14	Channel #7 Reverse Flow Limit	16,384	0x4000
3	15	Channel #8 Reverse Flow Limit	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
4	0	Channel #1 Flow Too Low	1	0x0001
4	1	Channel #2 Flow Too Low	2	0x0002
4	2	Channel #3 Flow Too Low	4	0x0004
4	3	Channel #4 Flow Too Low	8	0x0008
4	4	Channel #5 Flow Too Low	16	0x0010
4	5	Channel #6 Flow Too Low	32	0x1120
4	6	Channel #7 Flow Too Low	64	0x0040
4	7	Channel #8 Flow Too Low	64	0x0080
4	8	Channel #1 Flow Too High	256	0x0100
4	9	Channel #2 Flow Too High	512	0x0200
4	10	Channel #2 Flow Too High	1,024	0x0400
4	11	Channel #4 Flow Too High	2,048	0x0800
4	12	Channel #5 Flow Too High	4,096	0x1000
4	13	Channel #6 Flow Too High	8,192	0x2000
4	14	Channel #7 Flow Too High	16,384	0x4000
4	15	Channel #8 Flow Too High	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
5	0	Channel #1 No Master Flow	1	0x0001
5	1	Channel #2 No Master flow	2	0x0002
5	2	Channel #3 No Master flow	4	0x0004
5	3	Channel #4 No Master Flow	8	0x0008
5	4	Channel #5 No Master flow	16	0x0010
5	5	Channel #6 No Master Flow	32	0x1120
5	6	Channel #7 No Master Flow	64	0x0040
5	7	Channel #8 No Master Flow	64	0x0080
5	8	Channel #1 External Gun Enable Input Not Detected	256	0x0100
5	9	Channel #2 External Gun Enable Input Not Detected	512	0x0200
5	10	Channel #3 External Gun Enable Input Not Detected	1,024	0x0400
5	11	Channel #4 External Gun Enable Input Not Detected	2,048	0x0800
5	12	Channel #5 External Gun Enable Input Not Detected	4,096	0x1000
5	13	Channel #6 External Gun Enable Input Not Detected	8,192	0x2000
5	14	Channel #7 External Gun Enable Input Not Detected	16,384	0x4000
5	15	Channel #8 External Gun Enable Input Not Detected	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
6	0	Channel Card #1 Not Present	1	0x0001
6	1	Channel Card #2 Not Present	2	0x0002
6	2	Channel Card #3 Not Present	4	0x0004
6	3	Channel Card #4 Not Present	8	0x0008
6	4	Reserved	16	0x0010
6	5	Reserved	32	0x1120
6	6	Reserved	64	0x0040
6	7	Reserved	64	0x0080
6	8	Gun #1 Non-Existent Job #	256	0x0100
6	9	Gun #2 Non-Existent Job #	512	0x0200
6	10	Gun #3 Non-Existent Job #	1,024	0x0400
6	11	Gun #4 Non-Existent Job #	2,048	0x0800
6	12	Gun #5 Non-Existent Job #	4,096	0x1000
6	13	Gun #6 Non-Existent Job #	8,192	0x2000
6	14	Gun #7 Non-Existent Job #	16,384	0x4000
6	15	Gun #8 Non-Existent Job #	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
7	0	Gun #1 Flow Out of Range	1	0x0001
7	1	Gun #1 Flow Out of Range	2	0x0002
7	2	Gun #3 Flow Out of Range	4	0x0004
7	3	Gun #4 Flow Out of Range	8	0x0008
7	4	Gun #5 Flow Out of Range	16	0x0010
7	5	Gun #6 Flow Out of Range	32	0x1120
7	6	Gun #7 Flow Out of Range	64	0x0040
7	7	Gun #8 Flow Out of Range	64	0x0080
7	8	System Halted	256	0x0100
7	9	Reserved	512	0x0200
7	10	Reserved	1,024	0x0400
7	11	Reserved	2,048	0x0800
7	12	Reserved	4,096	0x1000
7	13	Reserved	8,192	0x2000
7	14	Reserved	16,384	0x4000
7	15	Reserved	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
8	0	Reserved	1	0x0001
8	1	Reserved	2	0x0002
8	2	Reserved	4	0x0004
8	3	Reserved	8	0x0008
8	4	Reserved	16	0x0010
8	5	Reserved	32	0x1120
8	6	Reserved	64	0x0040
8	7	Reserved	64	0x0080
8	8	Reserved	256	0x0100
8	9	Reserved	512	0x0200
8	10	Reserved	1,024	0x0400
8	11	Reserved	2,048	0x0800
8	12	Reserved	4,096	0x1000
8	13	Reserved	8,192	0x2000
8	14	Reserved	16,384	0x4000
8	15	Reserved	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
9	0	Reserved	1	0x0001
9	1	Reserved	2	0x0002
9	2	Reserved	4	0x0004
9	3	Reserved	8	0x0008
9	4	Reserved	16	0x0010
9	5	Reserved	32	0x1120
9	6	Reserved	64	0x0040
9	7	Reserved	64	0x0080
9	8	Reserved	256	0x0100
9	9	Reserved	512	0x0200
9	10	Reserved	1,024	0x0400
9	11	Reserved	2,048	0x0800
9	12	Reserved	4,096	0x1000
9	13	Reserved	8,192	0x2000
9	14	Reserved	16,384	0x4000
9	15	Reserved	32,768	0x8000

Alarm Word	Bit	Reset Selected Total	Decimal Value	Hex Value
10	0	Reserved	1	0x0001
10	1	Reserved	2	0x0002
10	2	Reserved	4	0x0004
10	3	Reserved	8	0x0008
10	4	Reserved	16	0x0010
10	5	Reserved	32	0x1120
10	6	Reserved	64	0x0040
10	7	Reserved	64	0x0080
10	8	Reserved	256	0x0100
10	9	Reserved	512	0x0200
10	10	Reserved	1,024	0x0400
10	11	Reserved	2,048	0x0800
10	12	Reserved	4,096	0x1000
10	13	Reserved	8,192	0x2000
10	14	Reserved	16,384	0x4000
10	15	Reserved	32,768	0x8000

Calibration Table - Type 07

RIO Calibration Table block transfers are used to automatically calibrate the Channels under PLC control.

SYSTEM CONFIGURATION - Type 04CALIBRATION TABLE - Type 07				
	BTR		BTW	
Word	Description	Units/Value	Description	Units/Value
0	Previous BTW Type	00 to 08	BTW Type	07
1	BTR Type	7	Next BTR Type	00 to 08
2	Channel #6 Actual Flow Rate	1 to 8	Channel # and NEXT BTR Channel #	1 to 8
3	Job #	1 to 100	Job # and NEXT BTR Job #	1 to 100
4	Flow Rate	CC/min	Flow Rate	Automatic = CC/min Manual = 0 to 100%
5	Analog Output	0 to 255	Calibration control Word	Bit Field
6	Pulses Per Liter	PPL % 10,000	New Puleser Per Liter	PPL % 10,,,
7		PPL / 10,000		PPL / 10,000
8	Calibration Per Liter (low word)	PPL / 10,000		
9	Calibration Per Liter (high word)	PPL / 10,000		

The Calibration Control Word bit field is defined as follows:

Bit	Reset Selected Total	Decimal Value	Hex Value
0	Mode (0 = Automatic, 1 = Manual)	1	0x0001
1	Update PPL for Current Job	2	0x0002
2	Update PPL for All Jobs	4	0x0004
3	Populate Lookup Table	8	0x0008
4	Reserved	16	0x0010
5	Reserved	32	0x1120
6	Reserved	64	0x0040
7	Reserved	64	0x0080
8	Reserved	256	0x0100
9	Reserved	512	0x0200
10	Reserved	1,024	0x0400
11	Reserved	2,048	0x0800
12	Reserved	4,096	0x1000
13	Reserved	8,192	0x2000
14	Reserved	16,384	0x4000
15	Stop Calibration (Population)	32,768	0x8000

CALIBRATION PROCEDURES FOR RIO

Normal Calibration

1. Set the Control Word to either Automatic (0x000) or Manual (0x0001). Clear all other bits in the Control Word.

2. Set the New Pulses Per Liter to zero.

3. Execute a BTW to start the calibration.

4. Execute a Null BTW, specifying a Type 07 BTR, followed by a BTR until Calibration (Population) Completed Bit (0x8000) is set or the Calibration (Population) Failed Bit (0x4000) is set.

5. Accept actual quantity flowed from operator input and calculate the New Pulses Per Liter value based on the elapsed time.

6. Set either the Update PPL for Current Job (0x0002) or Update PPL for All Jobs (0x0004) bit and clear all other bits in the Control Word.

7. Execut a BTW to write the New Pulses Per Liter to complete the calibration.

8. To abort the calibration procedure, set the Stop Calibration (Population) (0x8000) bit in the Control Word and issue a BTW.

Lookup Table Population

1. Set the Control Word to Lookup Table Population (0x0008).

2. Execute a BTW to start the population sequence.

3. Issue repeated BTR's until the Calibration (Population) Completed bit (0x8000) is set, or the Calibration (Population) Failed (0x4000) bit is set.

4. To abort the Population procedure, set the Stop Calibration (Population) (0x8000) bit in the Control Word and issue a BTW.

NOTES

Lookup Tables - Type 08

RIO Calibration Table block transfers are used to automatically calibrate the Channels under PLC control.

LOOKUP TABLES - Type 08				
	BTR		BTW	
Word	Description	Units/Value	Description	Units/Value
0	Previous BTW Type	00 to 08	BTW Type	08
1	BTR Type	8	Next BTR Type	00, or 01 to 08
2	Gun #	1 to 8	Gun # and Next BTR Gun #	1 to 8
3	Job #	1 to 100	Job # and Next BTR Job #	1 to 100
4	Entry #1 - Flow Rate	CC/min	Entry #1 - Flow Rate	CC/min
5	Entry #1 - Analog Output	0 to 255	Entry #1 - Analog Output	0 to 255
6	Entry #2 - Flow Rate	CC/min	Entry #2 - Flow Rate	CC/min
7	Entry #2 - Analog Output	0 to 255	Entry #2 - Analog Output	0 to 255
8	Entry #3 - Flow Rate	CC/min	Entry #3 - Flow Rate	CC/min
9	Entry #3 - Analog Output	0 to 255	Entry #3 - Analog Output	0 to 255
10	Entry #4 - Flow Rate	CC/min	Entry #4 - Flow Rate	CC/min
11	Entry #4 - Analog Output	0 to255	Entry #4 - Analog Output	0 to 255
12	Entry #5 - Flow Rate	CC/min	Entry #5 - Flow Rate	CC/min
13	Entry #5 - Analog Output	0 to 255	Entry #5 - Analog Output	0 to 255
14	Entry #6 - Flow Rate	CC/min	Entry #6 - Flow Rate	CC/min
15	Entry #6 - Analog Output	0 to 255	Entry #6 - Analog Output	0 to 255
16	Entry #7 - Flow Rate	CC/min	Entry #7 - Flow Rate	CC/min
17	Entry #7 - Analog Output	0 to 255	Entry #7 - Analog Output	0 to 255
18	Entry #8 -Flow Rate	CC/min	Entry #8 - Flow Rate	CC/min
19	Entry #8 - Analog Output	0 to 255	Entry #8 - Analog Output	0 to 255
20	Entry #9 - Flow Rate	CC/min	Entry #9 - Flow Rate	CC/min
21	Entry #9 - Analog Output	0 to 255	Entry #9 - Analog Output	0 to 255
22	Entry #10 - Flow Rate	CC/min	Entry #10 - Flow Rate	CC/min
23	Entry #10 - Analog Output	0 to 255	Entry #10 - Analog Output	0 to 255

ITW RANSBURG HOST SIO

SIO Operation

The Ransburg Host Serial I/O port is capable of communicating with a general purpose computer, personal computer (PC), or PLC via its SIO port.

All DynaFlow parameters, configurations, and operational data can be transferred between the DynaFlow Interface Module and a PLC via the SIO communicatiion link. Each type of data uses a unique protocol packet structure for the transfer. The description of the data parameters can be referenced in the ***DynaFlow User's Manual*** and the ***DynaFlow Operator Interface Manual*** with the exception of the differences that exist with the Ransburg Host SIO operation.

SIO Protocol

The DynaFlow Interface Module communicates with a host computer using RS-232C or as described on the previous pages.

Each protocol packet begins with the "#" (0x23) ASCII character. After the initial character, the message length is sent next. The length is the number of data bytes that follow and does not include the initial character, length, or the ending character, which is always a carriage return (0x0D).

Data may be sent in any of three sizes. Byte size data is sent simply as the hex value 0x00 to 0xFF. Sixteen (16) bit words are sent as two bytes with the high order byte sent first. Thirty-two (32) bit integers are sent as four bytes with the high order byte sent first.

All gun, channel, and job numbers are sent as zero-based values. In other words, gun or channel numbers are sent as 0 to 7 and job numbers are sent as 0 to 99.

Some data must be sent in a special manner. For example, the number of Channels and the Gun number may be concatenated into one byte with the upper nibble containing the Channel number and the lower nibble contains the Gun number.
Each protocol packet sent by the host computer must be confirmed as received by the Interface Module before the host computer attempts to send another packet. Failure to adhere to this standard will result in the loss of data received by the Interface Module and may lead to the inability to communicate properly with the Interface Module. If the Interface Module responds with an acknowledge packet (i.e. ACK) but fails to respond with the requested data after 500 milliseconds, the host computer should resend the request for data.

If the Interface Module replies with a NACK message, the host should resend the previous message.

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
<00>	**Re-Send Previous Data**	**Request for Re-Send of data from Host**
<01>	**Request for Gun Process data:** <01><LL><0G> Where: 1) <LL> = message length =<01h> 2) <0G> = Gun #. Allow at least 100 milliseconds between requests.	**Response:** <01><LL><0G><TR><RR><RR><MA><MA><MP><SA><SA><SP><AS><AS> Where: 1) <LL> = message length=<0Ch>. 2) <0G> = Gun #. 3) <TR> = Current trigger status, <00> = OFF, and <FF> = ON. 4) <RR><RR> = Current ratio x 100. 5) <MA><MA> = Master Channel actural flow rate in CC/min. 6) <MP> = Master Channel PID output voltage (or current) being sent to the transducer. 7) <SA><SA> = Slave Channel actual flow rate in CC/min. 8) <SP> = Slave Channel PID output voltage (or current) being sent to the transducer. 9) <AS><AS> = Analog set point in CC/min. Note: If all eight (8) Guns are congigured, 120 (8x(11+4)) characters must be sent per request. At 19.2 Kbaud, this will require 60 milleseconds. This is the reason for limiting the time between requests to perhaps 100 milliseconds.
<02>	**Request for Job data:** <02><LL><AG><JJ> Where: 1) <LL> = message length=<02h>. 2) <AG> = Gun # and if "A"= 1, Job is active, and if "A"= 0, Job is inactive. 3) <JJ> = Job #.	**Response:** <02><LL><AG><JJ><RR><RR><FS><FS><MX><MX><MN><MN> <LF><LF><MH><ML><PL><PL><PL><PL><DB><DB><PG><PG> <IG><IG><DG><DG><MH><ML><PL><PL><PL><PL><DB><DB><PG> <PG><IG><IG><DG><DG> Where: 1) <LL> = message length = <28h>. 2) <AG> = Gun #G and if "A" = 1, Job is active and if "A"=0, Job is inactive. 3) <JJ> = Job # 4) <RR><RR> = current ratio x 100. 5) <FS><FS> = flow set point in CC's/min. 6) <MX><MX> = maximum flow CC's/min. 7) <MN><MN> = minimum flow CC's/min. 8) <LF><LF> = pot life in seconds. Master Channel Variables: 9) <MH> = MVR high value. 10) <ML> = MVR low value.

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
		11) <PL><PL><PL><PL> = pulses per liter. 12) <DB><DB> = dead band. 13) <PG><PG> = proportional gain. 14) <IG><IG> = integral gain. 15) <DG><DG> = derivative gain. Slave Channel Variables: 16) <MH> = MVR high value. 17) <ML> = MVR low value. 18) <PL><PL><PL><PL> = pulses per liter. 19) <DB><DB> = dead band. 20) <PG><PG> = porportional gain. 21) <IG><IG> = integral gain. 22) <DG><DG> = derivative gain. Note: The data for the slave channel will be included whether or not the Gun is configured for two channels.
<03>	**Request for Gun Process data:** <03><LL><OG> Where: 1) <LL> = message length=<01h>. 2) <OG> = Gun #.	**Response:** <03><LL><NG><MS><MD><CC><DJ><RF><RF><MX><MX><FT> <FT><FT><FT><TT><TT><TV><TV><TF><TF><TN><TN><VT><VT> <MH><MH><SH><SH><GI><GI><<GO><GO><RG><FI><FI><FO><RS> Where: 1) <LL> = message length = <23h>. 2) <NG> = # of Channels in the upper nibble and the Gun # in the lower nibble. 3) <MS> = Master Channel # in the upper nibble and the Slave Channel # in lower nibble. 4) <MD> = Gun mode, <00> for Automatic, <01> for Manual, <02> for undefined. 5) <CC> = Clean Channels Enable/Disable 0x00 = Both Channels Enabled 0x0F = Master Channel Enabled/Slave Disabled 0xF0 = Slave Channel Enabled/Master Disabled 0xFF = Both Channels Disabled 6) <DJ> = Default Job #. 7) <RF><RF> = Reverse Flow. 8) <MX><MX> = Mixed Volume. 9) <FT><FT><FT><FT> = Flow Tolerance. 10) <TT><TT> = Flow Tolerance Time. 11) <TV><TV> = Tolerance Volume. 12) <TF><TF> = Trigger Off delay. 13) <TN><TN> = Trigger On delay. 14) <VT><VT> = Tolerance Volume Time (not used)

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
		15) <MH><MH> = Master Channel hardware word (see below). 16) <SH><SH> = Slave Channel hardware word (see below). 17) <GI><GI> = Gun Input word (see below). 18) <GO> = Gun Output byte (see below). 19) <RG> = RIO Gun Input byte (see below). 20) <FI><FI> = Forced Gun Input word (see below). 21) <FO> = Forced gun Output byte (see below). 22) <RS> = RIO System Input byte (see below). Hardware Word: Bit 0 = DR1 1:1 Bit 1 = DR1 1:2 Bit 2 = DR1 1:3 Bit 3 = DR1 1:4 Bit 4 = DR1 1:6 Bit 5 = DR1 1:8 Bit 6 = DR1 1:10 Bit 7 = MVR #2 Bit 8 = MVR #3 Bit 9 = MVR #4 Bit 10 = Other Gun Input & Forced Gun Input words: Bit 0 = Trigger Bit 1 = Run Bit 2 = Halt Bit 3 = Clean Bit 4 = Enable Bit 5 = Total Reset Bit 6 = Total Hold Bit 7 = Transparent Mode Bit 8 = Analog Hold Bit 9 = Gun Mask Bit 10 = Load Bit 11 = External Gun Fault RIO Gun Input byte: Bit 0 = Trigger Bit 1 = Run Bit 2 = Transparent Mode Bit 3 = Total Hold Bit 4 = Halt Bit 5 = Total Reset Bit 6 = Clean Bit 7 = Load

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
		Gun Output & Forced Gun Output bytes: Bit 0 = Ready bit 1 = Active Bit 2 = Fault Bit 3 = Pot Life Fault Bit 4 = Clean Bit 5 = Load Bit 6 = Calibrate Bit 7 = MVR Enable RIO System Input byte: Bit 0 = System Halt Bit 1 = Fault Reset Bit 2 = Global Gun Enable
<04>	**Request for System Configuration data:** <04><LL> Where: 1) <LL> = message length = <00>.	**Response:** <04><LL><HV><HV><IV><IV><S1><S2><BO><PT> <HC><HC><PW><PW><PW><PW><SI><SI><SO><SO> <C1><C1><C2><C2><C3><C3><C4><C4><12><34><56><78> Where: 1) <LL> = message length = <1Eh>. 2) <HV><HV> = Host Vergion (hex value). 3) <IV><IV> = Interface Version (hex value). 4) <S1><S2> = Interface Module DIP SW1 and SW2. 5) <BO> = Blow Off Time in seconds. 6) <PT> = Password Timer. 7) <HC><HC> = Horn Code (see below). 8) <PW><PW><PW><PW> = Password. 9) <SI><SI> = System Input word 10) <SO><SO> = System Output word. 11) <C1><C1> = Channel Card #1 Version (hex value). 12) <C2><C2> = Channel Card #2 Version (hex value). 13) <C3><C3> = Channel Card #3 Version (hex value). 14) <C4><C4> = Channel Card #4 Version (hex value). 15) <12> = Channel Card #1 DIP Switch (hex value). 16) <34> = Channel Card #2. DIP Switch (hex value). 17) <56> = Channel Card #3. DIP Switch (hex value). 18) <78> = Channel Card #4. DIP Switch (hex value). Horn Code: Bit 0 = Fault Bit 1 = Pot Life time exceeded Bit 2 = External System input word: Bit 0 = Job Select BCD 001.

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
		Bit 1 = Job Select BCD 002 Bit 2 = Job Select BCD 004 Bit 3 = Job Select BCD 008 Bit 4 = Job Select BCD 010 Bit 5 = Job Select BCD 020 Bit 6 = Job Select BCD 040 Bit 7 = Job Select BCD 080 Bit 8 = Job Select BCD 100 Bit 9 = Job Select Strobe Bit 10 = System Enable/Fault Bit 11 = Global Gun Enable System Output word: Bit 0 = System Fault Bit 1 = System Pulse Bit 2 = System Spare
<05>	**Request Flow Totals for Job:** <05><LL><0C><JJ> Where: 1) <LL> = message length = <02h) 2) <0C> = Channel # 3) <JJ> = Job #	**Response:** <05><LL><OC><JJ><DF><DF><DF><DF><YF><YF><YF><YF> <CA><CA><CA><CA><GF><GF><GF><GF><DF><DF><DF><DF> <YF><YF><YF><YF><CA><CA><CA><CA><GT><GT><GT><GT> <CF><CF><CF><CF><AE><AE><AE><AE> Where: 1) <LL> = message length = <2Ah>. 2) <OC> = Channel #. 3) <JJ> = Job #. 4) <DF><DF><DF><DF> = Daily Total for Job. 5) <YF><YF><YF><YF> = YTD Total for Job. 6) <CA><CA><CA><CA> = Calibration Total for Job. 7) <GF><GF><GF><GF> = Grand Total for Job (YTD + Calibration). 8) <DF><DF><DF><DF> = Daily Total for All Jobs. 9) <YF><YF><YF><YF> = YTD Total for All Jobs. 10) <CA><CA><CA><CA> = Calibration Total for All Jobs. 11) <GT><GT><GT><GT> = Grand Total for All Jobs (YTD + Calibration). 12) <CF><CF><CF><CF> = Clean Total for All Jobs. 13) <AE><AE><AE><AE> = Summation of the Absolute Value of the Error Term.
<06>	**Request Operational Data for Gun:** **<06><LL><0G>**	**Response:** <06><LL><0G><FM><FM><FS><FS><GS><GS><TR><TR><RR><RR> <AS><AS><V1><V2><JQ><AJ>

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
	Where: 1) <LL> = message length = <01h>. 2) <0G> = Gun #.	Where: 1) <LL> = message length = <10h> 2) <0G> = Gun # 3) <FM><FM> = Filtered Master Channel Flow Rate 4) <FS><FS> = Filtered Slave Channel Flow Rate 5) <GS><GS> = Gun Status word (see below). 6) <TF> = Current trigger status, <00> = OFF, and <FF> = ON 7) <RR><RR> = Filtered Curent ratio x 100. 8) <AS><AS> = Analog set point in CC/min. 9) <V1> = Filtered Master Channel voltage output. 10) <V2> = Filtered Slave Channel voltage output. 11) <JQ> = Job Queue. 12) <AJ> = Active Job #. Gun Status word: Bit 0 = Pot Life Timer Expired Bit 1 = Active Bit 2 = Halted Bit 3 = Clean Mode Bit 4 = Enabled Bit 5 = Calibration Mode Bit 6 = Faulted Bit 7 = Ready Bit 8 = Busy Bit 9 = Not Configured Bit 10 = Load Mode Bit 11 = Configured Without Job #. Bit 12 = Auto-tune Mode Bit 13 = Transparent Mode Bit 14 = Analog Hold Bit 15 = Spare
<07>	**Request for Gun Process data:** <07><LL> Where: 1) <LL> = message length = <00>.	**Response:** <07><LL><E1><E1><E2><E2><E3><E3><E4><E4><E5><E5> <E6><E6><E7><E7><E8><E8><E9><E9><E10><E10> Where: 1) <LL> = message length = <14h>. 2) <E1><E1> = Latest Error Code 3) <E10><E10> = Oldest Error Code

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
		For Gun and Channel Codes, the gun or channel number appears in the lower nibble. System Codes / Error Description: 0xB000 = System Halted 0xB010 = Remote I/O (RIO) Communication Error 0xB020 = Invalid RIO BTW Code 0xB030 = Invalid RIO BTR code 0xB040 = Invalid RIO BTW/BTR Gun/Channel Number 0xB050 = Invalid RIO BTW/BTR Job Number 0xB060 = Invalid RIO BTW Word Count Gun Codes / Error Description: 0x202g = Pot Life Time Exceeded 0x205g = Out of Ration 0x206g = Gun Not Ready 0x207g = Gun Busy 0x908g = No External Gun Enable 0xA02g = Flow Rate Out of Range (Low or High) Channel Codes / Error Description: 0x901c = Ratio Out of Tolerance 0x902c = Reverse Flow Volume Exceeded 0x903c = Flow Rate Too Low 0x904c = Flow Rate Too Low 0x905c = Duplicate Channel Assigned 0x906c - Ki Parameter Too Small 0x907c = No Master Flow Rate 0x909c = Channel Not Present 0x911c = Out of Tolerance, Slave Flow Rate Too High 0x921c = Out of Tolerance, Slave Flow Rate Too Low Note: If sent unsolicited, only <E1><E1> should be evaluated by the User Interface, as the message was sent to report a System fault. Gun faults are received in the Gun Status word in a Type <06> message.
<08>	**Request for Start Calibration for a Channel:** <08><LL><0C><CN><CN><CS><CS> Where: 1) <LL> = message length = <05h>. 2) <0C> = Channel #. 3) <CN><CN> = Calibration control word (see below). 4) <CS><CS> = Automatic Mode Calibration set point, else <00><00>.	**Response:** ACK <FF>

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
	Calibration Control word: Bit 0 = Manual Mode (1), Auto Mode (0). Bit 1 = Save New P/L to Current Job. Bit 2 = Save New P/L to All Jobs. Bit 3 = Populate Lookup Table.	
<09>	**Request for Engineering Backdoor data:** <09><LL><0G><JJ> Where: 1) <LL> = message length = <02h>. 2) <0G> = Gun #. 3) <JJ> = Job #.	**Response:** <09><LL><0G><JJ><AN><PT><AT><KP><KP><KI><KI><KD> <KD><CP><CP><CI><CI><CD><CD><OP><OP><OI><OI><OD> <OD><UG><UG><UP><UP><DC><DC><DP><DP><CS><CS> <TS><TS><LT><LT><FR><FR><MC><MC> Where: 1) <LL> = message length = <29h>. 2) <0G> = Gun #. 3) <JJ> = Job #. 4) <AN> = Algorithm #. 5) <PT> = PID Update Time. 6) <AT> = Auto-tune Procedure <00> = Open Loop <01> = Closed Loop 7) <KP><KP> = Proportional contribution to voltage output. 8) <KI><KI> = Integral contribution to voltage output. 9) <KD><KD> = Derivative contribution to voltage output. 10) <CP><CP> = Calculated proportional closed loop gain. 11) <CI><CI> = Calculated integral closed loop gain. 12) <CD><CD> = Calculated derivative closed loop gain. 13) <OP><OP> = Calculated proportional open loop gain. 14) <OI><OI> = Calculated integral open loop gain 15) <OD><OD> = Calculated derivative open loop gain. 16) <UG><UG> = Ultimate gain for closed loop tuning. 17) <UP><UP> = Ultimate period for closed loop tuning. 18) <DC><DC> = Calculated % of full scale change of output voltage in open loop mode. 19) <DP><DP> = Calculated % of full scale change of fluid flow in open loop mode. 20) <CS><CS> = Calculated slope in open loop mode. 21) <TS><TS> = Measured lag time in open loop mode. 23) <FR><FR> = Filter in open loop mode. 24) <MC><MC> = Misc. Control word in open loop mode.

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
<0A>	**Request to Reset Daily Totals for a Channel for All Jobs:** <1A><LL><0C> Where: 1) <LL> = message length = <01h>. 2) <0C> = Channel #.	**Response:** ACK <FF>
<0B>	**Request to Reset YTD Totals for a Channel for All Jobs:** <0B><LL><0C> Where: 1) <LL> = message length = <01h> 2) <0C> = Channel #.	**Response:** ACK <FF>
<0C>	**Request to Reset Calibration Totals for a Channel for All Jobs:** <0C><LL><0C> Where: 1) <LL> = message length = <01h>. 2) <0C> = Channel #.	**Response:** ACK <FF>
<0D>	**Request to Reset Clean Totals for a Channel for All Jobs:** <0D><LL><0C> Where: 1) <LL> = message length = <01h>, 2) <0C> = Channel #.	**Response:** ACK <FF>
<0E>	**Request to Reset Daily Totals for a Channel for a Job:** <0E><LL><0C><JJ> Where: 1) <LL> = message length = <02h>. 2) <0C> = Channel #. 3) <JJ> = Job #.	**Response:** ACK <FF>
<0F>	**Request to Reset YTD totals for a Channel for a Job:** <0F><LL><0C><JJ> Where: 1) <LL> = message length = <02h>. 2) <OC> = Channel # 3) <JJ> = Job #.	**Response:** ACK <FF>

<table>
<tr><th>Command Type (hex)</th><th>Response Or Action From User Interface</th><th>Response Or Action From Interface Module</th></tr>
<tr><td><10></td><td>Request to Reset All Calibration Totals for a Channel for a Job:

<10><LL><0C><JJ>

Where:
1) <LL> = message length = <02h>.
2) <0C> = Channel #.
3) <JJ> = Job #</td><td>Response:

ACK
<FF></td></tr>
<tr><td><11></td><td>Request to Copy All Job Parameters from Gun/Job to a Range of Gun W/Job X to Gun Y/Job Z:

<11><LL><OG><JJ><OW><JX><OY><JZ>

Where:
1) <LL> = message length = <06h>.
2) <0G> = Source Gun #.
3) <JJ> = Source Job #.
4) <OW> = Starting Target Gun #.
5) <JX> = Starting Target Job #.
6) <OY> = Ending Target Gun #.
7) <JZ> = Ending Target Job #.

See Types <02> and <09> to see what information is transferred.</td><td>Response:

ACK
<FF>

Note: Wait 200 milliseconds before issuing another command to allow the Interface Module time to complete the transfer.</td></tr>
<tr><td><12></td><td>Request to Copy a Single Job Parameter from Gun/Job to a Range of Gun W/Job X to Gun Y/Job Z:

<12><LL><PP><OG><JJ><OW><JX><OY><JZ>

Where:
1) <LL> = message length = <07h>.
2) <PP> = Parameter # (see below).
3) <OG> = Source Gun #.
4) <JJ> = Source Job #.
5) <OW> = Starting Target Gun #.
6) <JX> = Starting Target Job #.
7) <OY> = Ending Target Gun #.
8) <JZ> = Ending Target Job #.</td><td>Response:

ACK
<FF>

Note: Wait 200 milliseconds before issuing another command to allow the Interface Module time to complete the transfer.</td></tr>
</table>

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
	See Types <02> and <09> to see what information is transferred. Parameters Numbers: Job Parameters: <00> = Ratio <01> = Flow Set Point <02> = Maximum Flow <03> = Minimum Flow <04> = Pot Life Timer Master Channel Variables: <0A> = MVR High <0B> = MVR Low <0C> = Pulses Per Liter <0D> = Dead Band <0E> = Proportional Gain <0F> = Integral Gain <10> = Derivative Gain Slave Channel Variables: <14> = MVR High <15> = MVR Low <16> = Pulses Per Liter <17> = Dead Band <18> = Proportional Gain <19> = Integral Gain <1A> = Derivative Gain Hidden Variables: <20> = Algorithm Number <21> = PID Update Time <22> = Auto-tune Procedure Number <23> = Proportional Part of Voltage Output <24> = Integral Part of Voltage Output <25> = Derivative Part of Voltage Output <26> = Closed-Loop Proportional Gain <27> = Closed-Loop Integral Time <28> = Closed-Loop Differential Time <29> = Open-Loop Proportional Gain <2A> = Open-Loop Integral Time <2B> = Open-Loop Derivative Time <2C> = Closed-Loop Ultimate Gain <2D> = Closed-Loop Ultimate Period <2E> = Open-Loop Delta Voltage Output <2F> = Open-Loop Delta Fluid Flow <30> = Open-Loop Calculated Slope <31> = Open-Loop Time for Calculated Slope <32> = Open-Loop Time Lag <33> = Filter <34> = Control Word	

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
<13>	**Request to Stop Calibration for a Channel:** <13><LL><0C> Where: 1) <LL> = message length = <01h>. 2) <0C> = Channel #.	**Response:** <13><LL><0C><CN><CN><CP><CP><CT><CT> Where: 1) <LL> = message length = <07h>. 2) <0C> = Channel #. 3) <CN><CH> = Calibration Control word. 4) <CP><CP> = # pulses received during calibration. 5) <CT><CT> = calibration time.
<14>	**Request to Copy Attached Pulses Per Liter to a Range of Jobs:** <14><LL><PL><PL><PL><PL><JW><CX><JY> Where: 1) <LL> = message length = <07h>, 2) <PL><PL><PL><PL> = pulses per liter. 3) <JW> = starting target Job #. 4) <CX> = starting target Channel #. 5) <JY> = ending target Job #.	**Response:** ACK <FF> Note: Wait 200 milliseconds before issuing another command to allow the Interface Module time to complete the transfer.
<15>	**Send Current Status of Gun Keys:** <15><LL><0G><OS><OS> Where: 1) <LL> = message length = <03h>. 2) <0G> = Gun #. 3) <OS><OS> = Operator Status word (see below). Operator Status word: Bit 0 = Trigger Bit 1 = Active mode Bit 2 = Halt Bit 3 = Clean mode Bit 4 = Bit 5 = Calibration mode Bit 6 = Reset Gun Fault Bit 7 = Bit 8 = Bit 9 = Bit 10 = Load Mode Bit 11 = Bit 12 = Auto-tune mode	**Response:** ACK <FF>

ITW Ransburg
Electrostatic Systems

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
	Bit 13 = Bit 14 = Bit 15=	
<16>	**Request to Force Analog Output:** <16><LL><OC><A1><A2> Where: 1) <LL> = message length = <03h>. 2) <0C> = Channel #. 3) <A1> = D/A Output #1 4) <A2> = D/A Output #2.	**Response:** ACK <FF> Note: The Gun that the Channel is co nfigured to must be in Ready mode and not Active. The forced analog output value must be returned to <00> before requesting that the (Gun) become Active.
<17>	**Request for Current Analog Values:** <17><LL><0C> Where: 1) <LL> = message length = <01h>. 2) <0C> = Channel #.	**Response:** <17><LL><0C><AI><AI><SI><SI><TA><SA> Where: 1) <LL> = message length = <07h>. 2) <0C> = Channel #. 3) <AI><AI> = Analog Input. 4) <SI><SI> = Spare Analog Input. 5) <TA> = Transducer Analog Output 6) <SA> = Spare Analog Output
<18>	**Request to Rest Grand Total Volume for a Channel for a Job:** <18><LL><0C><JJ> Where: 1) <LL> = message length = <02h>. 2) <0C> = Channel #. 3) <JJ> = Job #.	**Response:** ACK <FF>
<19>	**Request to Reset Grand Total Volume for a Channel for All Jobs:** <18><LL><0C> Where: 1) <LL> = message length = <01h>. 2) <0C> = Channel #.	**Response:** ACK <FF> Note: Wait 200 milliseconds before issuing another command to allow the Interface Module time to complete the transfer.

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
<1A>	**Not Used.**	**Not Used.**
<1B>	**Not Used.**	**Not Used.**
<1C>	**Request tLookup Table data:** <1C><LL><0G><JJ> Where 1) <LL> = message length = <02h>. 2) <OG> = Gun #. 3) <JJ> = Job #.	**Response:** <1C><LL><OG><JJ> <F0><F0><O0><F1><F1><O!><F2><F2><O2><F3><F3><O3> <F4><F4><O4><F5><F5><O5><F6><F6><O6><F7><F7><O7> <F8><F8><O8><F9><O9> Where: 1) <LL> = message length = <20h>. 2) <0G> = Gun #. 3) <JJ> = Job #. 4) <F0><F0> = Flow Rate for Entry #0. 5) <O0)> = Output for Entry #0. 6) <F1><F1> = Flow Rate for entry #1. 7) <O1> = Output for entry #1. 8) <F2><F2> = Flow Rate for entry #2. 9) <O2> = Output for entry #2. 10) <F3><F3> = Flow Rate for entry #3. 11) <O3> = Output for entry #3. 12) <F4><F4> = Flow Rate for entry #4. 13) <O4> = Output for entry #4. 14) <F5><F5> = Flow Rate for entry #5. 15) <O5> = Output for entry #5. 16) <F6><F6> = Flow Rate for entry #6. 17) <O6> = Output for entry #6. 18) <F7><F7> = Flow Rate for entry #7. 19) <O7> = Output for entry #7. 20) <F8><F8> = Flow Rate for entry #8. 21) <O8> = Output for entry #8. 22) <F9><F9> = Flow Rate for entry #9. 23) <O9> = Output for entry #9.

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
<1D>	**Job Directory:** <1D><LL><0G> Where: 1) <LL> = message length = <01h>. 2) <0G> = Gun #.	**Response:** <1D><LL><0G><D0><D1><D2><D3><D4><D5><D6><D7><D8>- <D9><DA><DB><DC> Where: 1) <LL> = message length = <0Eh>. 2) <0G> = Gun #. 3) <D0> = Job Directory bits for Jobs 1 to 8. 4) <D1> = Job Directory bits for Jobs 9 to 16. 5) <D2> = Job Directory bits for Jobs 17 to 24. 6) <D3> = Job Directory bits for Jobs 25 to 32. 7) <D4> = Job Directory bits for Jobs 33 to 40. 8) <D5> = Job Directory bits for Jobs 41 to 48. 9) <D6> = Job Directory bits for Jobs 49 to 56.] 10) <D7> = Job Directory bits for Jobs 57 to 64. 11) <D8> = Job Directory bits for Jobs 65 to 72. 12) <D9> = Job Directory bits for Jobs 73 to 80. 13) <DA> = job Directory bits for Jobs 81 to 88. 14) <DB> = Job Directory bits for Jobs 89 to 96. 15) <DC> = Job Directory bits for Jobs 97 to 100.
<1E>	**RIO BTR/BTW Buffer:** <1E><LL><DL><DH> Where: 1) <LL> = message length = <02h>. 2) <DL> = Debug Mask to capture buffer (low byte). 3) <DH> = Debug Mask to capture buffer (high byte). Debug Mask: Bit 0 = Not Used Bit 1 = Not Used Bit 2 = Not Used Bit 3 = Not Used Bit 4 = Not Used Bit 5 = Select BTR Messages Bit 6 = Select BTW Messages Bit 7 = Not Used Bit 8 = RIO BTR/BTW Type 01 - Operational Data Bit 9 = RIO BTR/BTW Type 01 - Gun Configuration Data Bit 10 = RIO BTR/BTW Type 01 - Job Table Data Bit 11 = RIO BTR/BTW Type 01 - System Configuration Data Bit 12 = RIO BTR/BTW Type 01 - Flow Totals Data Bit 13 = RIO BTR/BTW Type 01 - Alarms Data Bit 14 = RIO BTR/BTW Type 01 - Calibration Control Data Bit 15 = RIO BTR/BTW Type 01 - Lookup Table Data	**Response:** <1E><LL><DL><DH><00h><7Fh> Where: 1) <LL> = message length = <82h>. 2) <DL> = Debug Mask used to capture buffer (low byte). 3) <DH> = Debug Mask used to capture buffer (high byte). 4) <00h> = Firts RIO Buffer word (low byte). 5) <01h> = First RIO Buffer word (high byte). 6) ..... 7) <7Eh> = Lsst RIO Buffer word (low byte). 8) <7Fh> = Last RIO Buffer word (high byte).

Command Type (hex)	Response Or Action From User Interface	Response Or Action From Interface Module
<FF>	**Not Used.**	**Response:** ACK <FF> Where: 1) <FF> = Acknowledge for all write messages. Data serves as ASK for read requests.

NOTES

INSTALLATION

RIO Hardware Settings

The DynaFlow Interface Module (77377-02) has several DIP switch settings that establish the operating characteristics of the RIO port.

RIO Rack Address

The RIO Rack Address is used to indicate to which RIO rack the Interface Module is assigned. RIO Rack Addresses are specified in octal format. There are 64 decimal possible Rack Addresses, which are assigned 00 through 77 octal.

There are five (5) words of discrete inputs and five (5) words of discrete output possible for each DynaFlow Interface Module. Each DynaFlow Interface Module supports up to four (4) Channel Cards and each Channel Card has two (2) Channels for a total of eight (8) Channels. The PLC discrete I/O RIO output bits are logical OR'd with the discrete I/O hard-wired signals so that either hard-wired signals or PLC control signals may control the system. Likewise, the DynaFlow hard-wired outputs are sent to the PLC via the discrete I/O RIO inputs.

The DynaFlow system uses two-slot addressing and appears to a PLC as a collection of 8-bit modules of I/O. In other words, each module has 8 inputs and 8 outputs. The Interface Module appears as a single 8-bit I/O module in slot 1, or the odd slot of a pair of slots. Therefore, the Interface Module, which reports the System I/O signals, uses the high byte of word 0.

Each DynaFlow Channel Card appears as two 8-bit I/O modules. The first channel appears in the low byte and the second channel appears in the high byte of each successive word in the RIO discrete I/O space.

With two-slot addressing, each rack contains 8 I/O groups (0-7). The following table describes how DynaFlow is assigned within a rack.

STARTING QUARTER				
I/O Group	**Ø**	**1**	**2**	**3**
0	Interface Module			
1	Channel Module #1			
2	Channel Module #2	Interface Module		
3	Channel Module #3	Channel Module #1		
4	Channel Module #4	Channel Module #2	Interface Module	
5		Channel Module #3	Channel Module #1	
6		Channel Module #4	Channel Module #2	Interface Module
7			Channel Module #3	Channel Module #1

The RIO Rack Address and SIO Multi-Drop Node Address is specified in SW1, positions 1-6 as shown below. (Factory default settings in bold)

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6	RIO Rack Address (Octal)
OFF	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**00**
OFF	OFF	OFF	OFF	OFF	ON	01
OFF	OFF	OFF	OFF	ON	OFF	02
OFF	OFF	OFF	OFF	ON	ON	03
OFF	OFF	OFF	ON	OFF	OFF	04
OFF	OFF	OFF	ON	OFF	ON	05
OFF	OFF	OFF	ON	ON	OFF	06
OFF	OFF	OFF	ON	ON	ON	07
OFF	OFF	ON	OFF	OFF	OFF	10
OFF	OFF	ON	OFF	OFF	ON	11
OFF	OFF	ON	OFF	ON	OFF	12
OFF	OFF	ON	OFF	ON	ON	13
OFF	OFF	ON	ON	OFF	OFF	14
OFF	OFF	ON	ON	OFF	ON	15
OFF	OFF	ON	ON	ON	OFF	16
OFF	OFF	ON	ON	ON	ON	17
OFF	ON	OFF	OFF	OFF	OFF	20
OFF	ON	OFF	OFF	OFF	ON	21
OFF	ON	OFF	OFF	ON	OFF	22
OFF	ON	OFF	OFF	ON	ON	23
OFF	ON	OFF	ON	OFF	OFF	24
OFF	ON	OFF	ON	OFF	ON	25
OFF	ON	OFF	ON	ON	OFF	26
OFF	ON	OFF	ON	ON	ON	27
OFF	ON	ON	OFF	OFF	OFF	30
OFF	ON	ON	OFF	OFF	ON	31
OFF	ON	ON	OFF	ON	OFF	32
OFF	ON	ON	OFF	ON	ON	33
OFF	ON	ON	ON	OFF	OFF	34
OFF	ON	ON	ON	OFF	ON	35
OFF	ON	ON	ON	ON	OFF	36
OFF	ON	ON	ON	ON	ON	37
ON	OFF	OFF	OFF	OFF	OFF	40
ON	OFF	OFF	OFF	OFF	ON	41
ON	OFF	OFF	OFF	ON	OFF	42
ON	OFF	OFF	OFF	ON	ON	43
ON	OFF	OFF	ON	OFF	OFF	44
ON	OFF	OFF	ON	OFF	ON	45
ON	OFF	OFF	ON	ON	OFF	46
ON	OFF	OFF	ON	ON	ON	47
ON	OFF	ON	OFF	OFF	OFF	50
ON	OFF	ON	OFF	OFF	ON	51
ON	OFF	ON	OFF	ON	OFF	52
ON	OFF	ON	OFF	ON	ON	53

(Continued on the next page)

(Continued from previous page)

SW1-1	SW1-2	SW1-3	SW1-4	SW1-5	SW1-6	RIO Rack Address (Octal)
ON	OFF	ON	ON	OFF	OFF	54
ON	OFF	ON	ON	OFF	ON	55
ON	OFF	ON	ON	ON	OFF	56
ON	OFF	ON	ON	ON	ON	57
ON	ON	OFF	OFF	OFF	OFF	60
ON	ON	OFF	OFF	OFF	ON	61
ON	ON	OFF	OFF	ON	OFF	62
ON	ON	OFF	OFF	ON	ON	63
ON	ON	OFF	ON	OFF	OFF	64
ON	ON	OFF	ON	OFF	ON	65
ON	ON	OFF	ON	ON	OFF	66
ON	ON	OFF	ON	ON	ON	67
ON	ON	ON	OFF	OFF	OFF	70
ON	ON	ON	OFF	OFF	ON	71
ON	ON	ON	OFF	ON	OFF	72
ON	ON	ON	OFF	ON	ON	73
ON	ON	ON	ON	OFF	OFF	74
ON	ON	ON	ON	OFF	ON	75
ON	ON	ON	ON	ON	OFF	76
ON	ON	ON	ON	ON	ON	77

RIO Rack Size

The RIO Rack Size must also be specified in order for the ASIC to communicate over the RIO link. The RIO Rack Size must be set to allow at least 2, 3, 4, or 5 discrete I/O words to be assigned to the DynaFlow Interface Module, depending on the number of Channel Cards included in the system. The Interface Module assigns one word for System I/O and one word for each Channel Card for up to four (4) Channel Cards. The RIO Rack Size is specified in SW2, positions 7 and 8 as shown below. (Factory default settings in bold)

SW2-7	SW2-8	# Discrete I/O Words	# Channel Cards	Rack Size
OFF	**OFF**	**2**	**1**	**1/4 Rack**
OFF	ON	4	2 or 3	1/2 Rack
ON	OFF	6	4	3/4 Rack
ON	ON	8	4	Full Rack

RIO Starting Quarter

The Starting Quarter within the rack must also be specified in order for the ASIC to communicate over the RIO link.

The RIO Starting Quarter is specified in SW1, positions 7 and 8 as shown below. (Factory default settings in bold)

SW1-7	SW1-8	Starting Quarter
OFF	**OFF**	**0**
OFF	ON	1/4
ON	OFF	1/2
ON	ON	3/4

RIO Baud Rate

The RIO Baud Rate must also be specified in order for the ASIC to communicate over the RIO link.

The RIO Baud Rate is specified in SW1, positions 3 and 4 as shown below. (Factory default settings in bold)

SW2-3	SW2-4	Baud Rate
OFF	**OFF**	**57.6 Kbaud**
OFF	ON	115.2 Kbaud
ON	OFF	230.4 Kbaud
ON	ON	230.4 Kbaud

RIO Non-Used Switch Settings

There are several switches that are either not used presently, or have a function that is not involved with RIO. They are noted here for clarity. (Factory default settings in bold)

Switch	OFF	ON
SW2-1	**Normal Operation**	Reset CMOS RAM to factory defaults
SW2-2	**Master Channel Outputs Gun Flow Rate**	Master Channel Outputs Master Channel Flow Rate
SW2-5	**See SIO Baud Rate**	See SIO Baud Rate
SW2-6	**See SIO Baud Rate**	See SIO Baud Rate

RIO Cable Connections

The RIO Connection is made using Allen-Bradely "Blue Hose." The connections are made at the rear of the DynaFlow back-plane on connector J8. If the DynaFlow rack is the last rack on the "Blue Hose," insert a 120 ohm, 1/8th watt resistor across terminals J8-12 and J8-14 in order to properly terminate the RIO cable to avoid standing waves which cause communication noise. This is extremely important for higher baud rates and industrial environments.

PLC RIO Cable	DynaFlow Back-Plane	120 Ohm, 1/8th Watt Terminating Resistor
Blue	J8-12	Between this terminal....
Shield	J8-13	Shield(s) Only
Clear	J8-14	....and this terminal.

SIO Hardware Settings

The DynaFlow Interface Module (77377-02) has several DIP switch and jumper settings that establish the operating characteristics of the SIO port.

SIO Port Configuration

Data Bits	Start Bits	Stop Bits	Parity	Flow Control
8	1	1	None	None

Since there is no hardware or software flow control, it is up to the receiving device at both ends of the connection to keep up with the sending device. It is recommended that the receiver be interrupt driven. Polling may be used to control the transmitter. The Interface Module utilizes interrupts to control both transmit and receive on the SIO port.

SIO Baud Rate

The SIO Baud Rate is specified in SW2, positions 5 and 6 as shown below:

SW2-5	SW2-6	SIO Baud Rate
OFF	**OFF**	**19.2 Kbaud**
OFF	ON	4.8 Kbaud
ON	OFF	9.6 Kbaud
ON	ON	38.4 Kbaud

SIO Driver Levels

The SIO port supports full duplex RS-232C or RS-422 driver levels. The following table shows the maximum cable lengths recommended for each level. Whenever possible, RS-422 should be utilized. The 19.2 Kbaud is the near the theoretical maximum baud rate for RS-232C and is more susceptible to electrical noise.

Driver Level	Max. Shielded Cable Length	Max. Unshielded Cable Length
RS-232C	50 Ft.	25 Ft.
RS-422	4,000 Ft.	4,000 Ft.

Jumper E5 on the Interface Module selects either RS-232C or RS-422 mode. Jumper E5 controls whether 120 ohm terminating resistor is installed for RS-422 or RS-485 operation. (Factory default settings in bold)

Driver Level	Jumper E5	Jumper E10 - 120 ohm Terminating Resistor
RS-232C	**2-3**	**X**
RS-422	1-2	Install

SIO Cable Connection

The SIO connection is made using two pair shielded cable. The connections are made at the rear of the DynaFlow backplane on connector J8.

DynaFlow Backplane	Connection
J8-1	RS-422 Receive (+)
J8-2	RS-422 Receive (-)
J8-3	RS-422 Transmit (+)
J8-4	RS-422 Transmit (-)
J8-5	RS-422 & RS-485 Ground
J8-6	RS-232C Receive
J8-7	RS-232C Transmit
J8-8	RS-232C Ground

NOTES

WARRANTY POLICIES

LIMITED WARRANTY

ITW Ransburg will replace or repair without charge any part and/or equipment that falls within the specified time (see below) because of faulty workmanship or material, provided that the equipment has been used and maintained in accordance with ITW Ransburg's written safety and operating instructions, and has been used under normal operating conditions. Normal wear items are excluded.

THE USE OF OTHER THAN ITW RANSBURG APPROVED PARTS, VOIDS ALL WARRANTIES.

SPARE PARTS: One hundred and eighty (180) days from date of purchase, except for rebuilt parts (any part number ending in "R") for which the warranty period is ninety (90) days.

EQUIPMENT: When purchased as a complete unit, (i.e., guns, power supplies, control units, etc.), is one (1) year from date of purchase. **WRAPPING THE APPLICATOR IN PLASTIC, SHRINK-WRAP, ETC., WILL VOID THIS WARRANTY.**

FLUID HANDLING: One (1) year from date of purchase (i.e., Totalizer, CCV Valves, etc.).

AIR BEARING ROTATORS: Fifteen thousand (15,000) hours or three (3) years, whichever occurs first. Warranty period begins on the date of purchase.

ITW RANSBURG'S ONLY OBLIGATION UNDER THIS WARRANTY IS TO REPLACE PARTS THAT HAVE FAILED BECAUSE OF FAULTY WORKMANSHIP OR MATERIALS. THERE ARE NO IMPLIED WARRANTIES NOR WARRANTIES OF EITHER MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ITW RANSBURG ASSUMES NO LIABILITY FOR INJURY, DAMAGE TO PROPERTY OR FOR CONSEQUENTIAL DAMAGES FOR LOSS OF GOODWILL OR PRODUCTION OR INCOME, WHICH RESULT FROM USE OR MISUSE OF THE EQUIPMENT BY PUR-CHASER OR OTHERS.

EXCLUSIONS:

If, in ITW Ransburg's opinion the warranty item in question, or other items damaged by this part was improperly installed, operated or maintained, Ransburg will assume no responsibility for repair or replacement of the item or items. The purchaser, therefore will assume all responsibility for any cost of repair or replacement and service related costs if applicable.

APPENDIX

PAINT AND SOLVENT SPECIFICATIONS

	REA™ / EFM™ EVOLVER™	REM™ / M90™	NO. 2 HAND GUN	TURBODISK™	AEROBELL® II*** AEROBELL® AEROBELL® 33 RMA-101™
RECOMMENDED VISCOSITY USING A ZAHN NO. 2	18 TO 30 SEC	18 TO 30 SEC	20 TO 60 SEC	20 TO 60 SEC	20 TO 60 SEC
PAINT ELECTRICAL RESISTANCE**	.1 MΩ TO ∞	.1 MΩ TO ∞	.1 TO 1 MΩ	.1 MΩ TO ∞	.1 MΩ TO ∞
RECOMMENDED DELIVERY (UP TO)	1000 cc/min	1500 cc/min	180 cc/min	1000 cc/min	500 cc/min

GUIDE TO USABLE SOLVENT SELECTION

Chemical Name	Common Name	Category	Flash Point†† (TCC)	*CAS Number	Evap. Rate†	Elec. Res.**
DICHLOROMETHANE	Methylene Chloride	Chlorinated Solvents		75-09-2	**14.5**	HIGH
VM & P NAPHTHA	Naptha	Aliphatic Hydrocarbons	65ºF	8030-30-6	**10**	HIGH
ACETONE		Ketones	-18ºF	67-64-1	**5.6**	LOW
METHYL ACETATE		Esters	90ºF	79-20-9	**5.3**	LOW
BENZENE		Aromatic Hydrocarbons	12ºF	71-43-2	**5.1**	HIGH
ETHYL ACETATE		Esters	24ºF	141-78-6	**3.9**	MEDIUM
2-BUTANONE	MEK	Ketones	16ºF	78-93-3	**3.8**	MEDIUM
ISO-PROPYL ACETATE		Esters	35ºF	108-21-4	**3.4**	LOW
ISOPROPYL ALCOHOL	IPA	Alcohols	53ºF	67-63-0	**2.5**	LOW
2-PENTANONE	MPK	Ketones	104ºF	107-87-9	**2.5**	MEDIUM
METHANOL	Methyl Alcohol	Alcohols	50ºF	67-56-1	**2.1**	LOW
PROPYL ACETATE	n-Propyl Acetate	Esters	55ºF	109-60-4	**2.1**	LOW
TOLUOL	Toluene	Aromatic Hydrocarbons	48ºF	108-88-3	**1.9**	HIGH
METHYL ISOBUTYL KETONE	MIBK	Ketones	60ºF	108-10-1	**1.6**	MEDIUM
ISOBUTYL ACETATE		Esters	69ºF	110-19-0	**1.5**	LOW
ETHANOL	Ethyl Alcohol	Alcohols		64-17-5	**1.4**	LOW
BUTYL ACETATE		***Esters***	**78ºF**	***123-86-4***	***1.0***	***LOW***
ETHYLBENZENE		Aromatic Hydrocarbons	64ºF	100-41-4	**.89**	HIGH
1-PROPANOL	n-Propyl Alcohol	Alcohols	74ºF	71-23-8	**.86**	LOW
2-BUTANOL	sec.-Butyl Alcohol	Alcohols	72ºF	78-92-2	**.81**	LOW
XYLOL	Xylene	Aromatic Hydrocarbons	79ºF	1330-02-07	**.80**	HIGH
AMYL ACETATE		Esters	106ºF	628-63-7	**.67**	MEDIUM
2-METHYLPROPANOL	iso-Butyl Alcohol	Alcohols	82ºF	78-83-1	**.62**	LOW
METHYL AMYL ACETATE		Esters	96ºF	108-84-9	**.50**	LOW
5-METHYL-2-HEXANONE	MIAK	Ketones	96ºF	110-12-3	**.50**	MEDIUM
1-BUTANOL	n-Butyl Alcohol	Alcohols	95ºF	71-36-3	**.43**	LOW
2-ETHOXYETHANOL		Glycol Ethers	164ºF	110-80-5	**.38**	LOW
2-HEPTANONE	MAK	Ketones	102ºF	110-43-0	**.40**	MEDIUM
CYCLOHEXANONE		Ketones	111ºF	108-94-1	**.29**	MEDIUM
AROMATIC-100	SC#100	Aromatic Hydrocarbons	111ºF		**.20**	HIGH
DIISOBUTYL KETONE	DIBK	Ketones	120ºF	108-83-8	**.19**	MEDIUM
1-PENTANOL	Amyl Alcohol	Alcohols		71-41-0	**.15**	LOW
DIACETONE ALCOHOL		Ketones	133ºF	123-42-2	**.12**	LOW
2-BUTOXYETHANOL	Butyl Cellosolve	Glycol Ethers	154ºF	111-76-2	**.07**	LOW
CYCLOHEXANOL		Alcohols	111ºF	108-93-0	**.05**	LOW
AROMATIC-150	SC#150	Aromatic Hydrocarbons	149ºF		**.004**	HIGH
AROMATIC-200		Aromatic Hydrocarbons	203ºF		**.003**	HIGH

FASTER ⇑ SLOWER ⇓

***** CAS Number: Chemical Abstract Service Number.
****** Electrical Resistance using the ITW Ransburg Meter.
******* Solvent Base Configuration Only.
† Information Obtained From: http://solvdb.ncms.org
†† The lowest temperature at which a volatile fluid will ignite.
Evaporation Rate is Based Upon Butyl Acetate Having a Rate of 1.0

© 05/2004 Illinois Tool Works Inc. All rights reserved.

NOTE: Chart provides resistance and control information that we feel is necessary when using ITW Ransburg equipment.

VISCOSITY CONVERSION CHART

Poise	Centipoise	DuPont Parlin 7	DuPont Parlin 10	Fisher 1	Fisher 2	Ford Cup 3	Ford Cup 4	Gardner - Holdt Bubble	Gardner - Lithographic	Krebs Unit KU	Saybolt Universal SSU	Zahn 1	Zahn 2	Zahn 3	Zahn 4	Zahn 5	Sears Craftsman Cup	Din Cup 4
.1	10	27	11	20			5	A-4			60	30	16					10
.15	15	30	12	25			8	A-3			80	34	17					11
.2	20	32	13	30	15	12	10				100	37	18					12
.25	25	37	14	35	17	15	12	A-2			130	41	19					13
.3	30	43	15	39	18	19	14	A-1			160	44	20					14
.4	40	50	16	50	21	25	18	A			210	52	22				19	15
.5	50	57	17		24	29	22			30	260	60	24				20	16
.6	60	64	18		29	33	25	B		33	320	68	27				21	18
.7	70		20		33	36	28			35	370		30				23	21
.8	80		22		39	41	31	C		37	430		34				24	23
.9	90		23		44	45	32			38	480		37	10			26	25
1.0	100		25		50	50	34	D		40	530		41	12	10		27	27
1.2	120		30		62	58	41	E		43	580		49	14	11		31	31
1.4	140		32			66	45	F		46	690		58	16	13		34	34
1.6	160		37				50	G		48	790		66	18	14		38	38
1.8	180		41				54		000	50	900		74	20	16		40	43
2.0	200		45				58	H		52	1000		82	23	17	10	44	46
2.2	220						62	I		54	1100			25	18	11		51
2.4	240						65	J		56	1200			27	20	12		55
2.6	260						68			58	1280			30	21	13		58
2.8	280						70	K		59	1380			32	22	14		63
3.0	300						74	L		60	1475			34	24	15		68
3.2	320							M			1530			36	25	16		72
3.4	340							N			1630			39	26	17		76
3.6	360							O		62	1730			41	28	18		82
3.8	380										1850			43	29	19		86
4.0	400							P		64	1950			46	30	20		90
4.2	420										2050			48	32	21		95
4.4	440							Q			2160			50	33	22		100
4.6	460							R		66	2270			52	34	23		104
4.8	480								00	67	2380			54	36	24		109
5.0	500							S		68	2480			57	37	25		112
5.5	550							T		69	2660			63	40	27		124
6.0	600							U		71	2900			68	44	30		135
7.0	700									74	3375				51	35		160
8.0	800								0	77	3380				58	40		172
9.0	900							V		81	4300				64	45		195
10.0	1000							W		85	4600					49		218
11.0	1100									88	5200					55		
12.0	1200									92	5620					59		

VISCOSITY CONVERSION CHART (Continued)

Poise	Centipoise	DuPont Parlin 7	DuPont Parlin 10	Fisher 1	Fisher 2	Ford Cup 3	Ford Cup 4	Gardner - Holdt Bubble	Gardner - Lithographic	Krebs Unit KU	Saybolt Universal SSU	Zahn 1	Zahn 2	Zahn 3	Zahn 4	Zahn 5	Sears Craftsman Cup	Din Cup 4
13.0	1300							X		95	6100					64		
14.0	1400								1	96	6480							
15.0	1500									98	7000							
16.0	1600									100	7500							
17.0	1700									101	8000							
18.0	1800							Y			8500							
19.0	1900										9000							
20.0	2000									103	9400							
21.0	2100										9850							
22.0	2200										10300							
23.0	2300							Z	2	105	10750							
24.0	2400									109	11200							
25.0	2500							Z-1		114	11600							
30.0	3000									121	14500							
35.0	3500							Z-2	3	129	16500							
40.0	4000									133	18500							
45.0	4500							Z-3		136	21000							
50.0	5000										23500							
55.0	5500										26000							
60.0	6000							Z-4	4		2800							
65.0	6500										30000							
70.0	7000										32500							
75.0	7500										35000							
80.0	8000										37000							
85.0	8500										39500							
90.0	9000										41000							
95.0	9500										43000							
100.0	10000							Z-5	5		46500							
110.0	11000										51000							
120.0	12000										55005							
130.0	13000										60000							
140.0	14000										65000							
150.0	15000							Z-6			67500							
160.0	16000										74000							
170.0	17000										83500							
180.0	18000										83500							
190.0	19000										88000							
200.0	20000										93000							
300.0	30000										140000							

Note: All viscosity comparisons are as accurate as possible with existing information. Comparisons are made with a material having a specific gravity of 1.0.

© 05/2004 Illinois Tool Works Inc. All rights reserved.

VOLUMETRIC CONTENT OF HOSE OR TUBE (English Units)

I.D. (inches)	cc/ft.	Cross Seaction (sq. in.)	Length				
			5ft. (60")	10ft. (120")	15ft. (180")	25ft. (300")	50ft. (600")
1/8	2.4	.012	.003 gal. .4 fl. oz.	.006 gal. .8 fl. oz.	.010 gal. 1.2 fl. oz.	.016 gal. 2.0 fl. oz.	.032 gal. 4.1 fl. oz.
3/16	5.4	.028	.007 gal. .9 fl. oz.	.014 gal. 1.8 fl. oz.	.022 gal. 2.8 fl. oz.	.036 gal. 4.6 fl. oz.	.072 gal. 9.2 fl. oz.
1/4	9.7	.049	.013 gal. 1.6 fl. oz.	.025 gal. 3.3 fl. oz.	.038 gal. 4.9 fl. oz.	.064 gal. 8.2 fl. oz.	.127 gal. 16.3 fl. oz.
5/16	15.1	.077	.020 gal. 2.5 fl. oz.	.040 gal. 5.1 fl. oz.	.060 gal. 7.6 fl. oz.	.100 gal. 12.7 fl. oz.	.199 gal. 25.5 fl. oz.
3/8	21.7	.110	.029 gal. 3.7 fl. oz.	.057 gal. 7.3 fl. oz.	.086 gal. 11.0 fl. oz.	.143 gal. 18.4 fl. oz.	.287 gal. 36.7 fl. oz.
1/2	38.6	.196	.051 gal. 6.5 fl. oz.	.102 gal. 13.1 fl. oz.	.153 gal. 19.6 fl. oz.	.255 gal. 32.6 fl. oz.	.510 gal. 65.3 fl. oz.

VOLUMETRIC CONTENT OF HOSE OR TUBE (Metric Units)

I.D. (mm)	cc/m	Cross Section (mm^2)	Length				
			1.5m	3.0m	4.5m	6.0m	7.5m
3.6	10.2	10.2	15.3 cc	30.5 cc	45.8 cc	61.1 cc	76.3 cc
5.6	24.6	24.6	36.9 cc	73.9 cc	110.8 cc	147.8 cc	184.7 cc
6.8	36.3	36.3	54.5 cc	109.0 cc	163.4 cc	217.9 cc	272.4 cc
8.8	60.8	60.8	91.2 cc	182.5 cc	273.7 cc	364.9 cc	456.2 cc

© 05/2004 Illinois Tool Works Inc. All rights reserved.

ITW Ransburg
Electrostatic Systems

MANUAL CHANGE SUMMARY

This manual was published to replace Service Manual ***LN-9406-00.1, DynaFlow Programmer's Manual***, to make the following changes:

1. New "Front Cover" depicting touch panel PC.

"Introduction Section"

2. Correct "Description for Word Offset 3 for Gun configuration RIO BTW - Type 02".

3. Noted "Tolerance Volume Time is Not Used for Gun configuration SIO command type 0x03".

4. Noted "Tolerance volume time is Not Used for Gun configuration SIO command type 0x03".

5. Corrected "description of Gun Input & Forced Gun Input Word bit 4 to be Enable for Gun configuration SIO command type 0x03".

6. Corrected "description of Gun Input & Forced Gun Input Word bit 11 to be External Gun Fault for Gun Configuration SIO command type 0x03".

7. Added "missing bytes denoted as 56><78> for System Configuration command".

8. Added "Error Code numbers and descriptions for Error Log command type 0x07".

9. Noted "response to a Start Calibration command type 0x08 is only an ACK".

10. Noted "response to a Reset Daily Totals for a Channel for All Jobs command type 0x0A is only an ACK".

11. Noted "response to a Reset Year-To-Date Totals for a Channel for All Jobs command type 0x0B is only an ACK".

12. Noted "response to a Reset Calibration Totals for a Channel for All Jobs command type 0x0C is only an ACK".

13. Noted "response to a Reset Clean Totals for a Channel for All Jobs Command type 0x0D is only an ACK".

14. Noted "response to a Reset Daily Totals for Channel for a Job command type 0x0E is only an ACK".

15. Noted "response to a Reset Year-To-Date Totals for a Channel for a Job command type 0x0F is only an ACK".

16. Noted "response to a Reset Calibration Totals for a Channel for a Job command type 0x10 is only an ACK".

17. Noted "response to a Copy All Job Parameters from Gun/Job to a Range of Gun W/Job X to Gun Y/Job Z command type 0x11 is only an ACK".

18. Noted "response to a copy a Single Job Parameter from Gun/Job to a Range of Gun W/ Job X to Gun Y/Job Z command type 0x12 is only an ACK".

19. Noted "response to a Copy Attached Pulses/Liter To a Range of Jobs command type 0x14 is only an ACK".

20. Noted "response to a Send Current Gun Key command type 0x15 is only an ACK".

21. Noted "response to a Send Forced Analog Output command type 0x16 is only an ACK.

22. Noted "response to a Reset Grand Total Volume for a Channel for a Job command type 0x18 is only an ACK".

23. Corrected "description of response packet for RIO BTW/BTR Buffer request command type 0x1E.

Service Manual Price: $50.00 (U.S.)

Manufacturing

1910 North Wayne Street
Angola, Indiana 46703-9100
Telephone: 260/665-8800
Fax: 260/665-8516

Technical/Service Assistance

Automotive Assembly and Tier I	Telephone: 800/ 626-3565	Fax: 419/ 470-2040
Industrial Systems	Telephone: 800/ 233-3366	Fax: 419/ 470-2071
Ransburg Guns	Telephone: 800/ 233-3366	Fax: 419/ 470-2071

Technical Support Representative will direct you to the appropriate telephone number for ordering Spare Parts.

© 2005 Illinois Tool Works Inc. All rights reserved.
Models and specifications subject to change without notice.

ISO 9001 Quality Systems

ENVIRONMENTALLY CONCERNED

Form No. LN-9406-00.2
Litho in U.S.A.
09/05