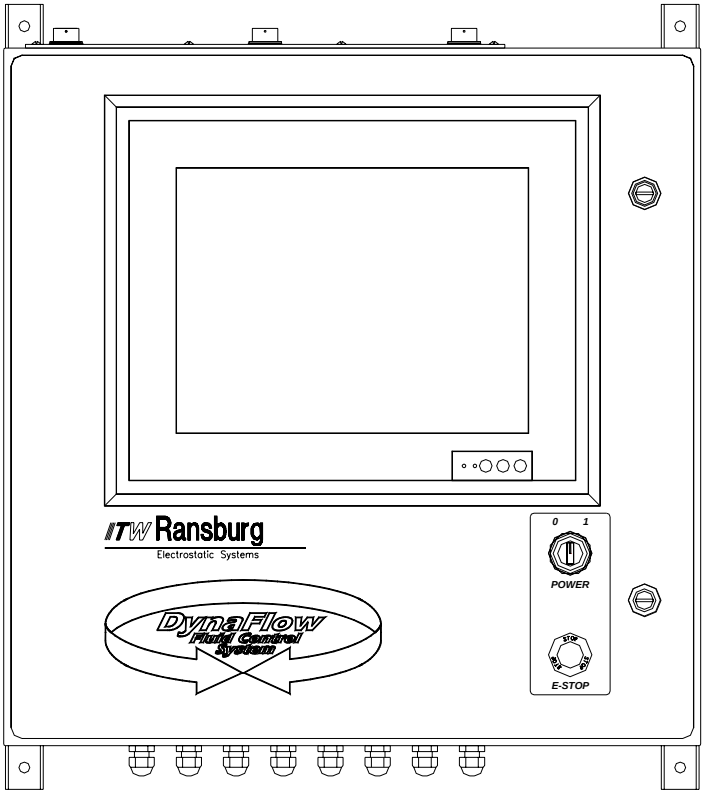
Ransburg

SERVICE MANUAL
LN-9401-00.5
(Replaces LN-9401-00.4)
March 2012

DYNAFLOW™ OPERATOR INTERFACE MANUAL



MODEL: 77376 and A12233

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 revision **LN-9401-00.4** to revision **LN-9401-00.5**. Reasons for this change are noted under “Manual Change Summary” inside the back cover of this manual.

CONTENTS

SAFETY

SAFETY PRECAUTIONS

Before operating, maintaining or servicing any Ransburg electrostatic coating system, read and understand all of the technical and safety literature for your 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 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 Ransburg system, contact your local Ransburg representative or Ransburg.

⚠ WARNING

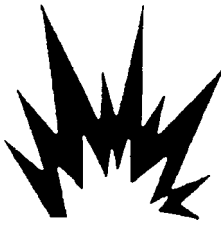
► The user **MUST** read and be familiar with the Safety Section in this manual and the Ransburg safety literature therein identified.

► 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 opera-tion 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 main-tained during cleaning operations using flammable or combust-ible 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.

AREA Tells where hazards may occur.	**HAZARD** Tells what the hazard is.	**SAFEGUARDS** Tells how to avoid the hazard.
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.
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.

AREA Tells where hazards may occur.	HAZARD Tells what the hazard is.	SAFEGUARDS Tells how to avoid the hazard.
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 sprayed and its concentration. Equipment must be as prescribed by an industrial hygienist or safety expert, and be NIOSH approved.

INTRODUCTION

This manual is intended as a guide for operators of the ***DynaFlow™ Fluid Flow Controller Model A12233***. This manual is intended as a compliment to the DynaFlow User and DynaFlow Programmer's Manuals. The detailed description of the operational parameters and system operation and/or procedures is located in the User manual. This manual specifically covers those items pertaining to the operation of the DynaFlow control software when installed in the Ransburg Operator Interface Panel or from a PC.

DESCRIPTION

The DynaFlow fluid flow control system achieves real-time closed loop control through the use of CHANNELs and GUNs. A CHANNEL consists of an electrical-to-pneumatic (E/P) transducer, material regulator, and fluid flow meter combination through which a single material is controlled. A GUN represents a single applicator through which one or more materials are delivered. One or more CHANNELs are configured for each GUN. Two-component delivery systems (referred to as 2K systems) have two CHANNELs assigned to a single GUN. The materials are statically mixed before being delivered to the GUN. This unit includes:

- A standard rack assembly populated with an Interface Module and the appropriate number of Channel Cards.
- Fiber optic receivers or intrinsic safety barriers for interfacing to the flow meters.
- Terminals and connectors for external control wiring.
- An Operator Interface that includes an embedded PC, control software, a 15" color display with integral touch screen.

The DynaFlow control software is a PC program that runs under the Windows XP operating system. The software can be installed in the Operator Interface assembly or a standard PC running Windows 9X, 2000, or XP.

The DynaFlow control software supplies the means to monitor and command the delivery of single-component or two-component fluids when used in conjunction with a rack-mounted Interface Module and Channel Cards. Reference the DynaFlow User manual for a detailed description of the DynaFlow system components and their relation to each other. An RS-232 connection is established between the Operator Interface assembly and the Interface Module located in the Eurocard rack assembly through which all information is passed. If the system was ordered with the optional color change sequencer, an Ethernet connection is established between the operator interface PC and the color change controller brain in the interface panel (A12182). All of the actual fluid control and system interfacing is accomplished through the card rack compo-nents. The Operator Interface simply supplies a convenient means to view and modify configurations and data and to send manual operational commands. Data can also be saved and retrieved through the Operator Interface.

The major components of the Operator Interface Assembly are:

- ***Integral Touch Panel***: The touch panel provides a convenient method of interacting with the user interface. The touch panel is chemically resistant and easy to clean.
- ***Embedded PC***: Embedded computers are reduced size versions of the standard desktop computers. This is done such that OEM suppliers can cost effectively include (embed) a computer, typically performing a dedicated function, into their design. Embedded PCs conform to industry standards and run the same software and operating system that are used in standard desktop computers. The DynaFlow software, for example, will operate the same on a desktop or industrial computer.

- ***USB Ports:*** USB ports are provided that may be used to save or load data.

- ***LCD Display***: The LCD display is a 15", 1024 X 768 pixel TFT active matrix color display with a built-in backlight.

- ***Interface Panel A12182:*** Contains the color change sequencer controller, E to P transducers, zener barriers, fiber optic receiver, solenoid valves, etc. necessary to interface with the control components.

SPECIFICATIONS

Power Input:	100-240 VAC, 1.6A, 50/60 HZ
LCD Display:	15" (38 cm), 1024 x 768 pixels, colors, Ultra wide viewing angle
CPU:	40 GB HDD 1 GB RAM
RS-232 Ports:	COM 1 attaches to the card rack Interface Module - 19200 BAUD, 8 data bits, 1 stop bit, no parity, No handshaking The serial port is connected to J8 on the card rack mother board as follows: - J8-9 RS-232A Receive (Rx) - J8-10 RS-232A Transmit (Tx) - J8-11 RS-232A Ground COM 2: Not used COM 3: Reserved for touch panel COM 4: Not used
USB Ports:	Drives D:, E:, F:, etc.
Ethernet:	10/100 BASE-T
Parallel Port:	Standard
Video Port:	Standard
DIO Port:	Not used

NOTE

➤ The embedded CPU board and interconnecting cable assemblies are subject to change.

INSTALLATION

- **REFER ALSO TO THE DYNAFLOW USER MANUAL**

INPUT POWER

Input supply voltage connections should be made from a **FUSED DISCONNECT**. Generally, conduit should be used for the input power wiring with the appropriate connectors into the Control Panel.

If there are large AC line voltage fluctuations or voltage transients such as those typically produced by heavy electric machinery or welding equipment, then a constant voltage transformer (CVT) or an UPS should be used between the FUSED DISCONNECT and the Control Panel.

NOTE

► If a constant voltage transformer (CVT) is to be used on the input to the Control Panel, use a CVT with a Volt-Amp (VA) output rating equal to or greater than the output voltage multiplied by the control panel fuse rating. Also make sure that the CVT input ratings correspond with the voltage and frequency of the source supplied by the FUSED DISCONNECT. The CVT output should be rated for 240 VAC maximum.

⚠ CAUTION

► The pilot light socket, located in the power switch that is located on the door, is rated for 120 VAC and must be changed if 240 VAC input power is used.

► The appropriate power line filter must be specified or operation at either 115 or 230 VAC.

INTRINSICALLY SAFE FLOWMETERS

(Refer to Figures 1a and 1b.)

SYSTEM CONNECTIONS

GUN Control I/O

All GUN specific control wiring to the control rack is terminated at the ribbon cable to discrete converter blocks TB1-TB4 located on the rear panel of the DynaFlow enclosure (refer to Figure 1c). For DynaFlow panels configured for use with the remote electrical-to-pneumatic interface panels, the GUN control wiring is supplied to circular connectors located on the top of the panel.

The GUN control I/O is ignored for any Slave (catalyst) CHANNELs. Therefore, connections need only be made to CHANNELs configured as Master CHANNELs.

Interface Panels

There are up to eight circular connectors located on top of the DynaFlow Control Panel depending on the number of CHANNELs. These are labeled GUN #1-GUN #8.

For two-component GUN's: Since all of the interface wiring necessary for a two-component GUN is supplied through a single cable to the LBAL5001 Interface Panel, connection for a two-component GUN must be made to the odd numbered GUN connectors (#1, #3, #5, or #7).

For single-component GUN's: Simply connect each GUN in order, GUN #1 to connector #1, etc.

System and Power I/O

All system control I/O, AC and DC power connections are made at terminal blocks comprising TB5 (refer to Figure 1c).

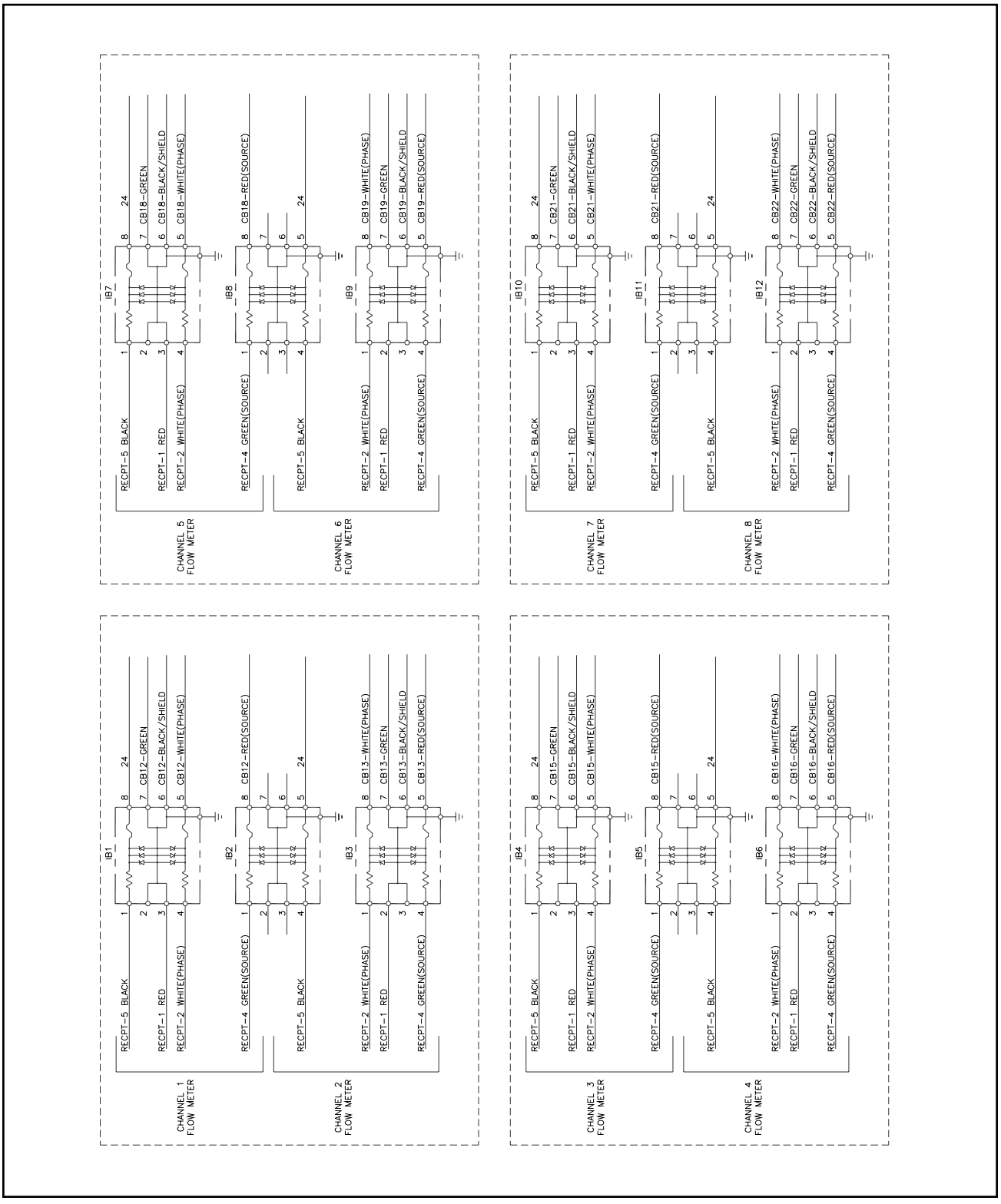
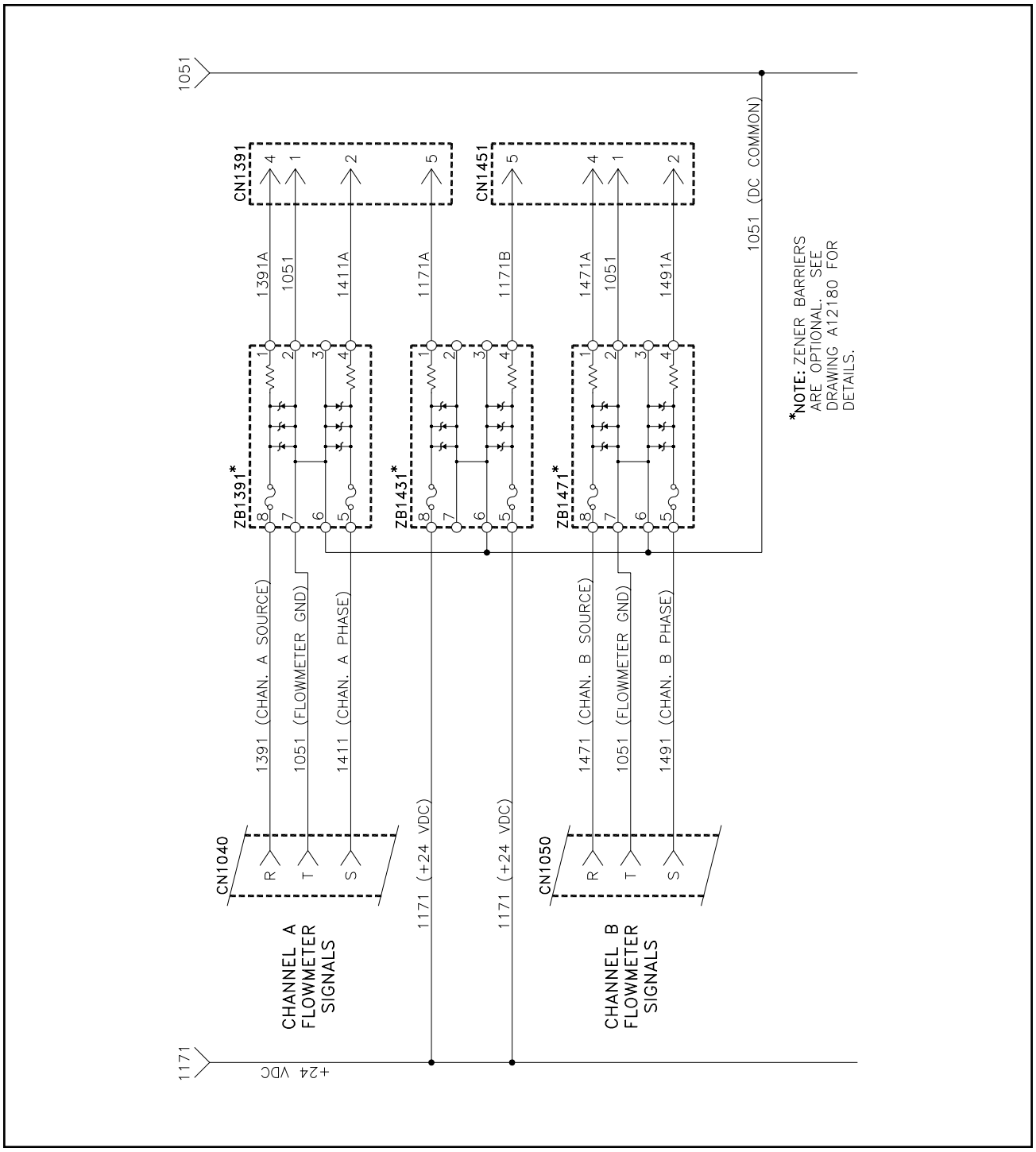


Figure 1a: Wiring for Intrinsically Safe Flowmeters (77376)



NOTE

► For the A12233 version of the DynaFlow, the zener barriers are housed in the A12182 interface panel.

Figure 1b: Wiring for Intrinsically Safe Flow Meters (A12233 Version)

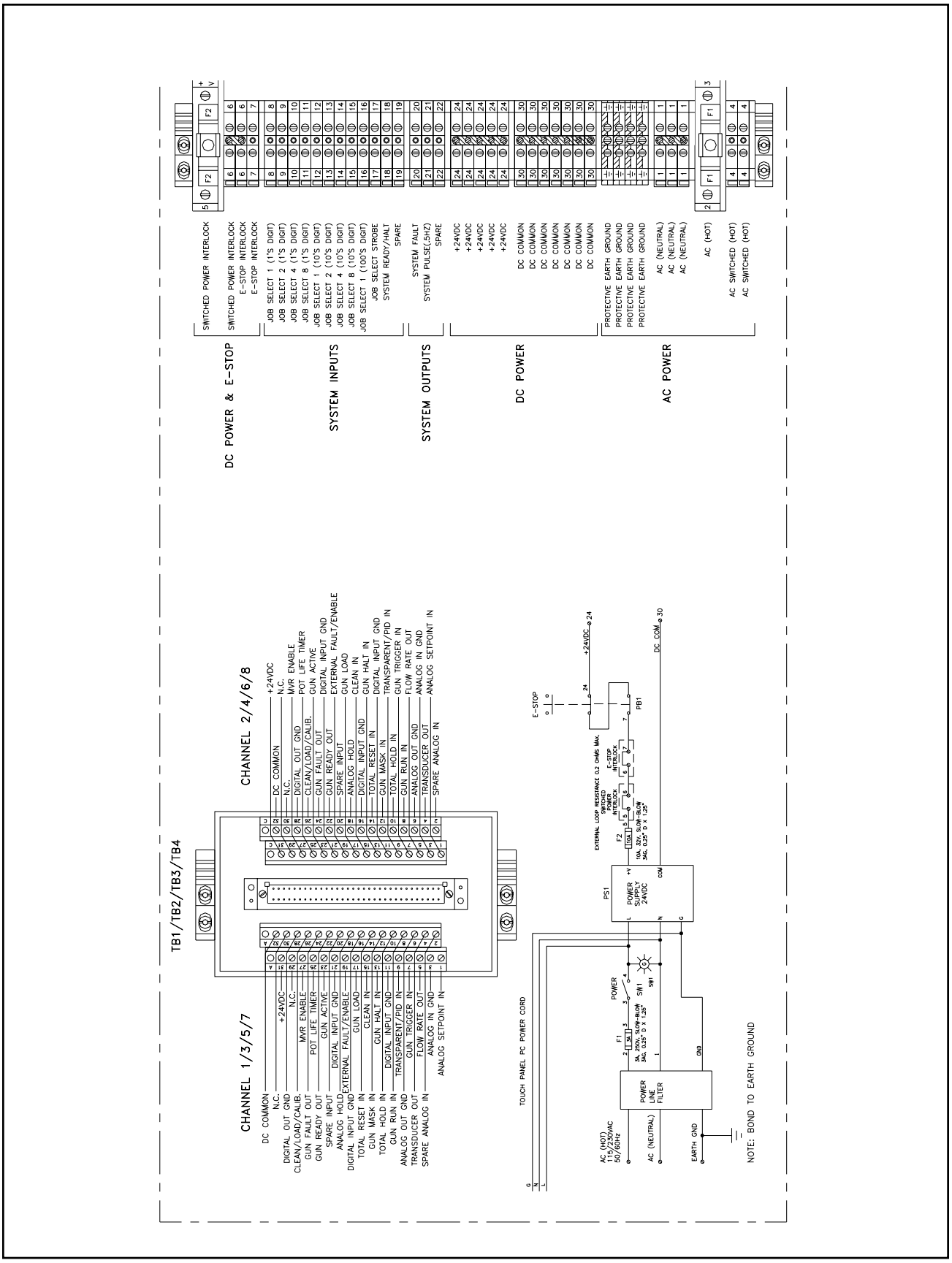


Figure 1c: System Connections (77376)

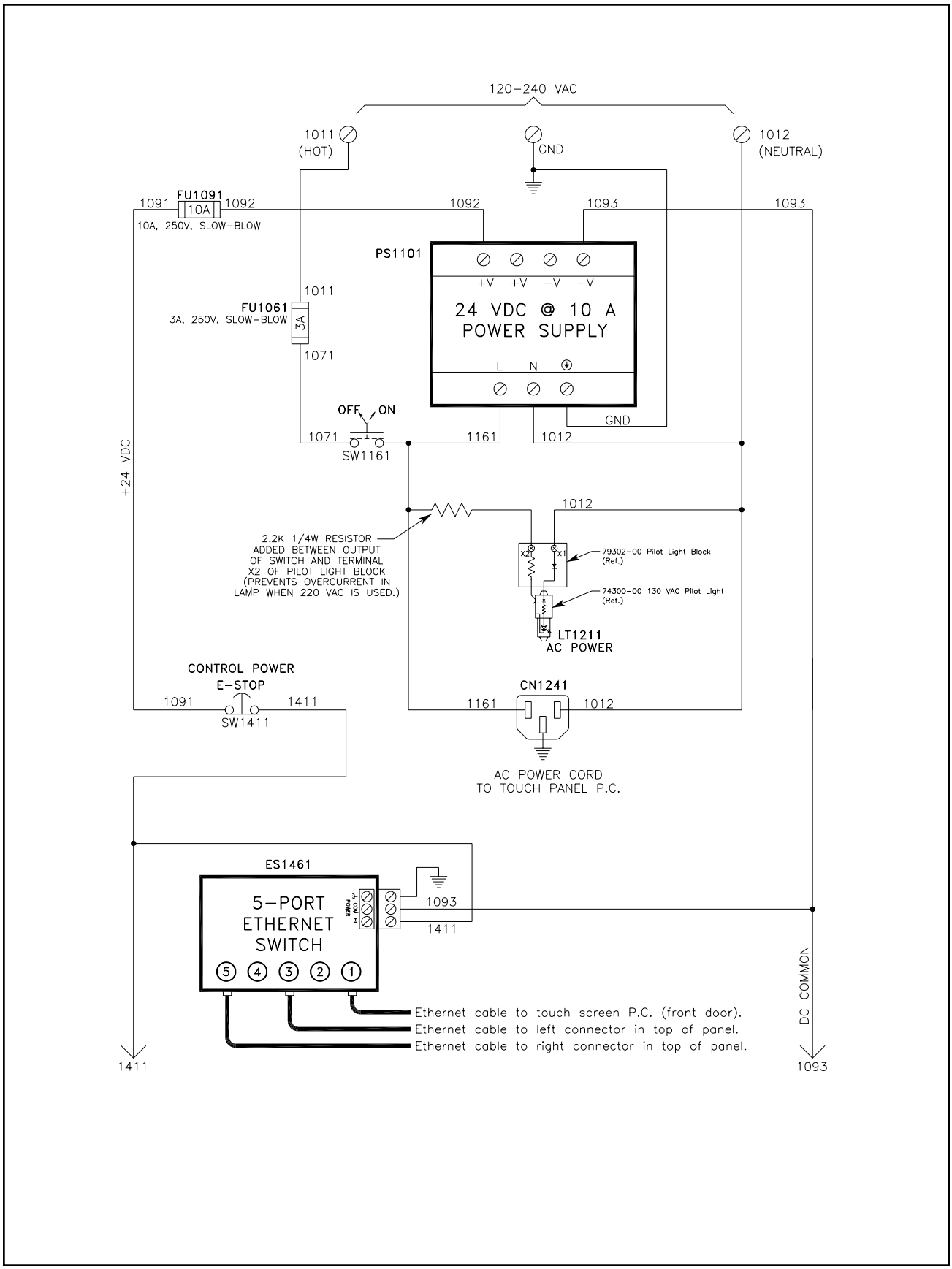


Figure 1d: Input Power Schematic

NOTES

OPERATION

GENERAL

The Operator Interface was designed to be user friendly and to supply all of the necessary information for the operation of the DynaFlow control directly to the operator. Most information located in the manuals regarding the operation of the DynaFlow system is available directly through the Operator Interface. All of the screens offer 'on-line' descriptive information and help text that includes troubleshooting. Graphic information is also displayed for a quick determination of system performance.

Power ON

When power is first applied to the DynaFlow system, the Interface and any installed Channel Cards located in the card rack immediately perform initialization and place all GUNs in the ready state assuming valid configurations and successful self tests. The Interface Module will determine which Channel Cards are installed and that they are communicating properly. The PC, upon application of power, will load the Windows XP operating system.

Power OFF

All analog and control outputs to the fluid system are removed if power is turned off to the card rack. This means that fluid flow will be immediately stopped for all CHANNELs. An Emergency Stop should be supplied for this purpose. The stand-alone DynaFlow panel incorporates an E-Stop front panel switch with an additional unused set of normally open and normally closed contacts for use by the customer to interlock other system functions.

The Emergency Stop switch does not remove AC power from the touch panel PC. The green On/Off switch removes AC power to the 24VDC power supply and the touch panel PC.

KEY FUNCTIONS

ESC

This key is used to exit any active screen or pop-up box.

F1 - F12 Function Keys

F1 through F12 are soft keys. The function of these keys will change depending on which screen is active. The description for each key is shown in boxes on the bottom of the display.

GUN 1 - GUN 8 ON/OFF

These keys allow manual activation and deactivation of each GUN. Pressing a GUN ON/OFF button is the same as supplying an external GUN RUN or GUN HALT input signal. When using a PC, the corresponding keys on the keyboard are (all lower case):

GUN 1	a
GUN 2	s
GUN 3	d
GUN 4	f
GUN 5	g
GUN 6	h
GUN 7	j
GUN 8	k

CURSOR (Arrow Keys)

The cursor keys allow the operator to move to a data field for editing or to a command field. In addition to pressing the ENTER key, edited data will also be accepted when a cursor key is pressed.

HOME

Pressing this key will return the editing cursor to the first data field in the screen.

LOAD (Backspace)

The LOAD key causes a small pop-up box to appear in the current screen. Any GUN can be manually placed in LOAD MODE by simply pressing the number for the desired GUN on the numeric portion of the keypad. The LOAD MODE is deactivated by pressing the GUN number again. This is the same as supplying an external GUN LOAD and GUN HALT input signals. When using a PC, the corresponding key on the keyboard is the backspace key.

CLEAN (Space Bar)

The CLEAN key causes a small pop-up box to appear in the current screen. Any GUN can be manually placed in CLEAN MODE by simply pressing the number for the desired GUN on the numeric portion of the keypad. The CLEAN MODE is deactivated by pressing the GUN number again. This is the same as supplying an external GUN CLEAN or GUN HALT input signal. When using a PC, the corresponding key on the keyboard is the space key.

HELP (Lower Case L)

The HELP key can be pressed at any time. It will provide more detailed help for the current active screen. In addition, there is troubleshooting information also available through the HELP screens. When using a PC, the corresponding key on the keyboard is lower case L.

ENTER

Edited information in the currently selected data field is accepted when the ENTER key is pressed. The next logical data field is then selected.

CLEAR FAULTS (Lower Case c)

Pressing this key will immediately clear any faults reported by the controller regardless of the current screen. If the fault resulted in the stoppage of fluid, then a GUN RUN signal is required to start flow again. Enter the ERROR LOG screen to view the error that occurred. Pot Life faults can only be 'cleared' by evacuating the volume of fluid as determined by the Mixed Volume parameter located in the GUN CONFIGURATION screen through the GUN or cycling power to the DynaFlow controller. Pressing the Clear Faults key will silence the horn. When using a PC, the corresponding key on the keyboard is lower case c.

Exit To Operating System

The **'*'** key followed by the F9 key, or CTRL with F1, from the main screen will exit to the operating system. From the touch screen, simply push F12. The password may be required.

PASSWORD OPERATION

The password is required for editing any system or GUN configurations, loading information from files, editing JOB tables or forcing I/O. A pop-up screen will appear requesting the password when attempting to perform a password protected operation. Once a password is entered correctly, it will not be required again until the password timer has elapsed. The password and password timer can be set in the SYSTEM CONFIGURATION screen. The password timer starts after the last keystroke is sensed. Every additional keystroke before the password timer elapses resets the timer. This makes it convenient for an operator to change multiple parameters without having to continually reenter the password. In the event that the password is lost or is not recognized by the controller, contact Ransburg Service. Entering a '0' for the password will disable password protection.

SCREENS

Main Screen

The appearance of the main screen will be determined by the number of CHANNELs installed and the GUN configurations. GUN faults may also be cleared from this screen. If the GUN configuration is changed, then the main screen will automatically reflect the changes when the operator returns to the main screen. Each GUN is shown in a box with the assigned CHANNEL(S). Relevant operational information is also shown in the GUN box such as GUN mode, GUN status, requested flow rate, actual flow rate and flow tolerance (error). The actual flow and tolerance are also shown in bar graph form.

The flow bar graphs are color coded as follows:

Green = Normal Flow
Red = Reverse Flow
White = Flow During Clean (Solvent)
Cyan = Flow During Load (Material)
Yellow = Flow During Pot-Life Alarm
Blue = Flow In the Ready State

Tolerance Bargraph

The far left ba rgraph of a dual-component gun on the main screen has traditionally been used to display ratio tolerance. With version 4.0.05 and later versions of the user-interface software, this bar graph has two new options; Mixed Volume and Pot Life. The bar graph can be configured in the Config. Gun Screen under the Display Mode parameter. The Mixed Volume option gives a graphical representation of the amount of mixed material in the tubing running from the spiral mix tube to the applicator. The Pot Life option gives a graphical representation of the age of the oldest mixed material (which is the material in the applicator at any point in time).

Configure System Screen (F1)

Contains system parameters that are not GUN or JOB specific.

The firmware versions and DIP switch settings of the Interface Module and Channel Cards are displayed in this screen.

The date and time may be changed in this screen.

Configure GUN Screen (F2)

Contains parameters that effect a GUN regardless of the JOB. The GUN configuration parameters should not be changed if the GUN is active. If a CHANNEL is to be reassigned to a different GUN, then it must first be removed from any other GUN.

Load JOB # (F3)

Simply allows the operator to select the next JOB for a GUN. The selected JOB is placed in a 'queue' for the selected GUN. The new JOB will be loaded at the next GUN RUN signal following a GUN HALT signal. A GUN can be halted by pressing the GUN ON/OFF key or supplying the GUN HALT/RESET hardware input. If the GUN is already in the halted state (ready), then no additional HALT signal is required. The main screen indicates the current JOB which was loaded at the time of the last GUN RUN command.

Edit JOB Screen (F4)

While in the EDIT JOBS screen, a selected parameter for the current JOB may be copied to any number of other JOBs or the entire JOB table can be copied to other selected GUNs and JOBs. This is accomplished by selecting the COPY PARAMETER and COPY JOB soft keys. Selecting either soft key will cause a pop-up screen to appear. The operator will be prompted to enter the requested range for GUNs and JOBs.

Digital/Analog I/O Screens (F5)

Allows the operator to view the status of system and GUN specific inputs and outputs as well as monitoring RIO PLC signals. The operator can also 'force' input and output states for trouble-shooting purposes.

Plotting Screen (F6)

Provides a convenient means to graphically monitor operational data with respect to time, similar to a data logging or charting device. This feature supplies the operator with fluid flow and related response information in order to evaluate the system or set up the control parameters for optimum performance. There are four parameters that can be selected for plotting. Each parameter is automatically given a unique color and is displayed with it's own corresponding scale and description. All of the possible plotting parameters are shown in the setup screen for each configured GUN. The operator can select any of the parameters for any of the GUNs. Touch the desired parameter and press the SELECT (F1) soft key to select that parameter. Pushing F1 again will remove the parameter. Each selected parameter will be displayed in a small box at the lower left of the setup screen along with the color assigned to that parameter. Once the desired parameters are selected, then press the PLOT soft key to start the plotting screen. The operator can then choose to scroll the plot continuously, freeze, or stop the plot, or save the screen to a compressed bit mapped file. The compressed file can then be

converted to a standard .BMP file by using the utility called decomp.exe located on the DynaFlow software Disk or on drive C: of the DynaFlow controller. Simply type 'decomp' followed by the name of the saved file.

Job Totals (F7)

The Job Totals screen allows users to monitor material usage. Values are stored according to the Job number so if each material being sprayed is assigned its own Job number, totals will be recorded for each material sprayed. There are two values stored for each material and each job and are known as a Daily Total and a Year to Date total. These totals are not related to the clock or calendar in any way, they are simply two totals that can be reset independent of each other. For instance, one may be used for a batch of parts total and the other may be used as a shift total, etc. Separate totals are also maintained for Clean mode (how much material flowed while the unit was in clean mode). Keep in mind that if solvent/ air chop cycles are used this total will not be extremely accurate. There is also an independent value recorded for volumes used while in the calibrate mode. Totals can also be reset on this screen except for the GRAND TOTALS. (This allows for a secure, non-resettable value for EPA reporting purposes.)

Calibration Screen (F8)

The calibration procedure is a CHANNEL (flow meter) specific operation and must be performed on only one CHANNEL at a time. The calibration screen offers a convenient means to verify or adjust the flow meter pulses per liter (P/L) setting based on actual measurements. The procedure can be performed by one person and eliminates the need to do manual calculations.

Color Change (F9)

An optional color change sequencer may have been included with the controller. If it was included, the F9 key will indicate as such. If the F9 key is blank, your system does not have this option. The optional *color change sequencer* is a PLC-like controller that performs the load, flush, and color change sequences that were programmed by the user from the color change setup screens. Load and flush sequences and times are downloaded to this controller (via Ethernet) by the user-interface P.C. every time a new Job Number is toggled into the respective gun. When this function is selected, the operator is first prompted for the gun number they wish to view or edit the sequence for, they are then prompted for which Job Number they wish to view and/or edit the sequences of, and last, they are asked if they want to view/edit the sequence for flushing or filling. (There is a separate flush sequence and load sequence stored for every Job Number and for every gun.)

Error Log Screen (F11)

This screen displays the previous 10 system errors or GUN faults that have occurred. For each of the errors, the error code and descriptive text will indicate the GUN and specific type of error. Errors can be cleared from the screen by pressing the F7 key. The actual fault condition can only be cleared by pressing the CLEAR FAULTS key or supplying a GUN HALT hardware input.

Load GUN

To manually place a GUN in LOAD MODE from the PC interface, push the LOAD key. A small pop-up box will appear in the upper left corner of the current screen. Simply push the number of the GUN to immediately start loading fluid for the selected GUN. The number selected will appear in the pop-up box. To stop loading a GUN, press the GUN number again. Push the ESC key to exit the LOAD MODE.

Clean GUN

To manually place a GUN in CLEAN MODE from the PC interface, push the CLEAN key. A small pop-up box will appear in the upper left corner of the current screen. Simply push the number of the GUN to immediately start cleaning for the selected GUN. Each CHANNEL assigned to a GUN can be selected as a 'clean' CHANNEL in the CONFIGURE SYSTEM screen. To stop cleaning, press the GUN number again. Push the ESC key to exit the CLEAN MODE. (Guns in clean mode when this screen is exited will remain in clean mode until the GUN ON/OFF button is pushed.)

NOTE

► The following is important to note when changing or entering data in the System Configuration, GUN Configuration, or Edit JOB screens. Any modifications to data made in these screens will **NOT** take effect until the "Store Data F5" key is pressed, which causes the new data to be sent to the DynaFlow Interface Module and automatically saved to the FLASH drive. If the "ESC" key is pressed first, any changes will be lost when exiting the screen. Each screen reads the data from the Interface Module upon entry to ensure that changes made by a PLC will be recognized by the DynaFlow program.

FILE I/O

Saving/Retrieving Data

System configuration, GUN configuration, JOB tables data, and flow totals can be saved or retrieved to disk files. Binary files (*.VAL) store the actual data and are the only type used to restore data. The binary files may be saved to either the FLASH drive C: or the floppy diskette drive A:

System configuration data:
SYSPAR.VAL
GUN configuration data:
GUNPAR.VAL
JOB tables:
PROGDATA.VAL
Totals:
TOTALS.VAL

The plotting screen is saved as a standard bitmap file (MMDDhhmm.BMP). The plot file names are formed from the month (MM), day (DD), hour (hh), and minute (mm) when the plot was saved. When saving a plot file, note the date and time in a log detailing what was plotted.

Data for all GUNs or all JOBs are saved automatically, regardless of the specific GUN or JOB being viewed or edited. For example, to save all JOB tables for all GUNs, simply enter the JOB EDIT screen for any GUN, any JOB, and press the "Save To File" key. The same is true for recalling data from previously saved files. To completely save all configuration and totals data:

- From the CONFIG SYSTEM screen, press the "Save To File" key.
- From the CONFIG GUN screen (select any GUN), press the "Save To File" key.
- From the EDIT JOB screen (select any GUN and any JOB), press the "Save To File" key.
- From the TOTALS screen, press the "Save To File" key.

To recall all previously saved configurations:

- From the CONFIG SYSTEM screen, press the "Read In File" key.
- From the CONFIG GUN screen (select any GUN), press the "Read In File" key.
- From the EDIT JOB screen (select any GUN and any JOB), press the "Read In File" key.
- From the TOTALS screen, press the "Read In File" key.

INSTALLING/UPDATING SOFTWARE

Installing New Software

To install or upgrade the DynaFlow software, follow the directions included with the media. Any previously stored data sets and/or configurations located on the hard drive will not be overwritten. This includes any configuration, JOB and Totals data previously saved. You will be prompted for any additional information that is required. It is recommended that all configuration and JOB data be saved to an USB memory stick before upgrading software.

Message Box

This is a small box located on some of the screens. The information displayed in this box describes illegal data or configuration entry attempts made by the operator, confirmation of a command or additional instructions.

Restoring the Windows XP Operating System

Contact Ransburg Technical Service if the operating system should become corrupted. A restore CD-ROM can be made available.

NOTES

PARAMETER LOCATIONS

The following lists the parameters associated with each screen.

F1 CONFIG SYSTEM

- Horn Code
- Blowoff Time
- Password Timeout
- RIO Rack Address
- RIO Rack Size
- RIO Starting Quarter
- RIO Baud Rate
- SIO Baud Rate
- SIO COM Port
- Channel Card #1 Verison
- Channel Card #2 Version
- Channel Card #3 Version
- Channel Card #4 Version
- Interface Module Version
- User Interface Version
- System Time
- System Date
- Select Language
- Channel Card #1 DIP SW1
- Channel Card #2 DIP SW1
- Channel Card #3 DIP SW1
- Channel Card #4 DIP SW1
- Interface Module DIP SW1
- Interface Module DIP SW2

F2 CONFIG GUN

- Mode (Auto/Manual)
- No. of CHANNELs
- Master CHANNEL
- Slave CHANNEL
- Clean CHANNELs
- Default JOB Number
- Flow Tolerance %
- Tolerance Volume
- Mixed Volume
- Flush Volume
- Trigger Off Delay
- Trigger On Delay
- Master CHANNEL Regulator Type
- Slave CHANNEL Regulator Type
- Reverse Flow Volume
- Bar Chart Maximum Flow Rate
- Flow Rate Tolerance Time
- Master Pot Volume
- Slave Pot Volume
- Display Mode

F3 SELECT JOB

F4 EDIT JOB

- Mix Ratio
- Master Percentage
- Slave Percentage
- Flow Rate Setpoint
- Maximum Flow Rate
- Minimum Flow Rate
- Pot Life Time
- Master MVR High Pressure
- Master MVR Low Pressure
- Master Pulses Per Liter
- Master Deadband
- Master Proportional Gain (Kp)
- Master Integral Gain (Ki)
- Master Dirative Gain (Kd)
- Slave MVR High Pressure
- Slave MVR Low Pressure
- Slave Pulses Per Liter
- Slave Deadband
- Slave Proportional Gain (Kp)
- Slave Integral Gain (Ki)
- Slave Derivative Gain (Kd)

F5 DIGITAL/ANALOG I/O

1: DISCRETE DIGITAL GUN I/O

INPUTS
- Trigger Gun
- Run Mode
- Halt Gun
- Clean Mode
- Spare Input
- Total Reset
- Total Hold
- Transparent
- Analog Hold
- Job # GUN Mask
- Load Mode
- Enable Gun
- Quad-Driver 1 OK (12-bit Only)
- Quad-Driver 2 OK (12-bit Only)
- Quad-Driver 3 OK (12-bit Only)
- 10-bit or 12-bit DAC

OUTPUTS
- Ready
- Run (Active) Mode
- Faulted
- Pot Life Alarm
- Clean/Load/Calibrate Mode
- MVR Enable

2: ANALOG I/O

INPUTS
- Flow Rate Set Point
- Spare Analog Input

OUTPUTS
- Control Pressure
- Actual Flow Rate
- Forced Control Pressure
- Forced Actual Flow Rate

3: DISCRETE AND REMOTE SYSTEM I/O

INPUTS
- JOB # 001
- JOB # 002
- JOB # 004
- JOB # 008
- JOB # 010
- JOB # 020
- JOB # 040
- JOB # 080
- JOB # 100
- JOB # Strobe
- JOB # Decimal
- System Ready
- Global GUN Enable
- RIO System Halt
- RIO Fault Reset
- RIO Global GUN Enable

OUTPUTS
- System Fault
- System Pulse
- System Spare

4: DISCRETE REMOTE I/O

INPUTS
- Trigger Gun
- Run Mode
- Transparent
- Total Hold
- Halt Gun
- Total Reset
- Clean Mode
- Load Mode

OUTPUTS
- Ready
- Run (Active) Mode
- Faulted
- Pot Life Alarm
- Clean Mode
- Load Mode
- Calibrate Mode
- MVR Enable

5: BTW/BTR REMOTE I/O BUFFER

- Display
  - Hex
  - Decimal
- BTW/BTR
  - BTW
  - BTR
- Data Type
  - Null
  - Operational
  - Gun Configuration
  - Job Configuration
  - System Configuration
  - Flow Totals
  - System Alarms
  - Calibration
  - Lookup Table
- Help

F6 PLOT DATA

Trigger
Requested Ratio
Actual Ratio
Requested Flow Rate
Actual Flow Rate
Master Requested Flow Rate
Master Actual Flow Rate
Master Control Pressure
Slave Requested Flow Rate
Slave Actual Flow Rate
Slave Control Pressure

F7 JOB FLOW TOTALS

FLOW TOTALS PER JOB

Daily Volume
Integral of Absolute Value (IABS) of Error Volume
Year To Date Volume
Calibrate Volume
Grand Total Volume

FLOW TOTALS FOR ALL JOBS

Daily Volume
Year To Date Volume
Calibrate Volume
Clean Volume
Grand Total Volume

F8 CALIBRATE PROCEDURE

Mode
Calibration Time
Calibration Flow Rate Set Point
Calibration Actual Flow Rate
Number of Pulses Received
Calculated Volume
Measured Volume
Measured Weight
Specific Gravity
Calculated Pulses/Liter
Current Pulses/Liter

F9 COLOR CHANGE FLUSH FILL

Step Duration
Resin Solvent Air Chop
Resin – Solvent
Resin – Air
Paint
Dump Valve
Resin Fluid Override
Trigger Solenoid
Catalyst #1 CCV
Catalyst #2CCV
Catalyst #3CCV
Catalyst Solvent
Catalyst Fluid Override
Run
Halt
Trigger
Load
Clean
Catalyst Disable
Chop Air Time
Chop Solvent Time

F11 ERROR LOG

SCREEN MENU TREE

NOTE: ESC is availble from any menu or pop-up box to return to the previous screen.

F1 CONFIG SYSTEM

Enter Password
- F1 Modify Value
- F3 Change Password
- F5 Store Data
- F7 Read In All Files
- F8 Save To All Files
- F9 Read In File
- F10 Save To File
- F11 Error Log

F2 CONFIG GUN

Enter Password
Select GUN #
- F1 Modify Value
- F2 Previous GUN
- F3 Next GUN
- F5 Store Data
- F9 Read In File
- F10 Save To File
- F11 Error Log

F3 SELECT JOB

Enter Password
- Select GUN #
  - Enter JOB #

F4 EDIT JOB

Enter Password
- Select GUN #
  - Enter JOB #
    - F1 Modify Value
    - F2 Next GUN
    - F3 Next JOB
    - F4 JOB Directory
    - F5 Store Data
    - F6 Lookup Talbe
    - F7 Copy Parameter
    - F8 Copy Job
    - F9 Read In File
    - F10 Save To File
    - F11 Error Log

F6 PLOT DATA

- F1 Select Variable
- F2 Plot Variable(s)
  - F1 Time 90/45 Seconds
  - F2 Single Plot/Scroll Plot
  - F3 Stop Plot/Start Plot
  - F5 Start Time Cursor ←
  - F6 Start Time Cursor →
  - F7 Stop Time Cursor ←
  - F8 Stop Time Cursor →
  - F10 Save To Plot
  - F11 Error Log
- F3 Clear All Variables
- F11 Error Log

F7 JOB FLOW TOTALS

Enter Password
- Enter JOB #
  - F1 Reset Total
  - F2 Reset CHANNEL
  - F3 Reset GUN
  - F4 Reset All
  - F5 Previous JOB
  - F6 Select JOB
  - F7 Next JOB
  - F8 Toggle Units
  - F9 Read In file
  - F10 Save To File
  - F11 Error Log

F8 CALIBRATION PROC.

Enter Password
- Enter CHANNEL #
  - Enter JOB #
    - F1 Modify (Mode)
    - F2 Start Calibration
    - F3 Stop Calibration
    - F4 Fluid Load
    - F10 Save To File
    - F11 Error Log
    - F7 Save New Pulses/Liter To This One JOB
    - F8 Save New Pulses/Liter To All JOBs
    - F11 Error Log

F11 ERROR LOG

- Clear Faults
- Clear Log
- Save To File
- Help

F12 SHUT DOWN

- 1 - Yes
- 2 - No

MAINTENANCE

There is no maintenance schedule for control panels other than good housekeeping practices. These include:

1. Keeping the door closed at all times. This will maintain the dust-tight environment required by the electronic printed circuit boards.

2. Plug all unused access holes into the cabinet in order to keep contamination out.

3. Use the following guidelines for cleaning the Operator Interface.

   Use cleaning solution specifically formulated for computer monitors, a mild window cleaner, or isopropyl alcohol. Most importantly, use a clean, soft paper towel or tissue and use very light force.

   The touch panel has been tested with Isopropyl Alcohol, Butyl Acetate, Methyl Ethyl Keystone, and Xylene, use of solvents to clean the surface should be minimized.

   Hint: If installed in a harsh environment where dirt or paint can accumulate, a sheet of clear plastic can be taped over the entire display.

For maintenance of system components other than the DynaFlow control panel, refer to the appropriate manual or contact Ransburg Customer Service.

TROUBLESHOOTING

The "Troubleshooting Guide" lists possible problems associated with the Operator Interface only. Reference the DynaFlow User manual for additional troubleshooting information not specific to the Operator Interface assembly.

NOTE

► Fluid flow control is not dependent on the Operator Interface being active. The system will operate and control fluid based on the last settings entered and the state of the hardware digital and/or analog I/O.

TROUBLESHOOTING GUIDE

General Problem	Cause	Solution
Serial Communication Error	1. Connected to wrong serial port	1. The PC should be connected to the Interface Module serial port 2. J8-9 (Rx) J8-10 (Tx) J8-11 (GND)
	2. Wiring to serial port incorrect	2. Check wiring to serial port.
	3. Interface Module not communicating	3. Observe the lights located on the front of the Interface Module. If they are all flashing slowly or indicate red, a problem with the Interface Module exists. Replace the Interface Module and restore configurations and JOB data.
	4. PC port not communicating	4. Check wiring and perform PC troubleshooting.
LCD Display	1. Display is blank	1. Press the display on/off button below the display.
Floppy Disk Drive	1. Green light on the disk drive does not turn on when reading or writing to the drive, or when booting the system	1. Contact Ransburg Service.
	2. The disk drive light comes on when attempting to read or write, but data errors occur	2. Try a different disk.
Touch Panel	1. Does not work	1. Contact Ransburg Service.
Password	1. The password is not recognized or has been forgotten	1. Contact Ransburg Service for instructions.
GUN Faults or System Errors	1. Error or faults reported in the Error Log screen	1. Refer to the help text on the screen and to current the DynaFlow User manual.
DynaFlow Software	1. Does not run, reports Windows error or C: drive not recognized	1. Contact Ransburg Service.

PARTS IDENTIFICATION

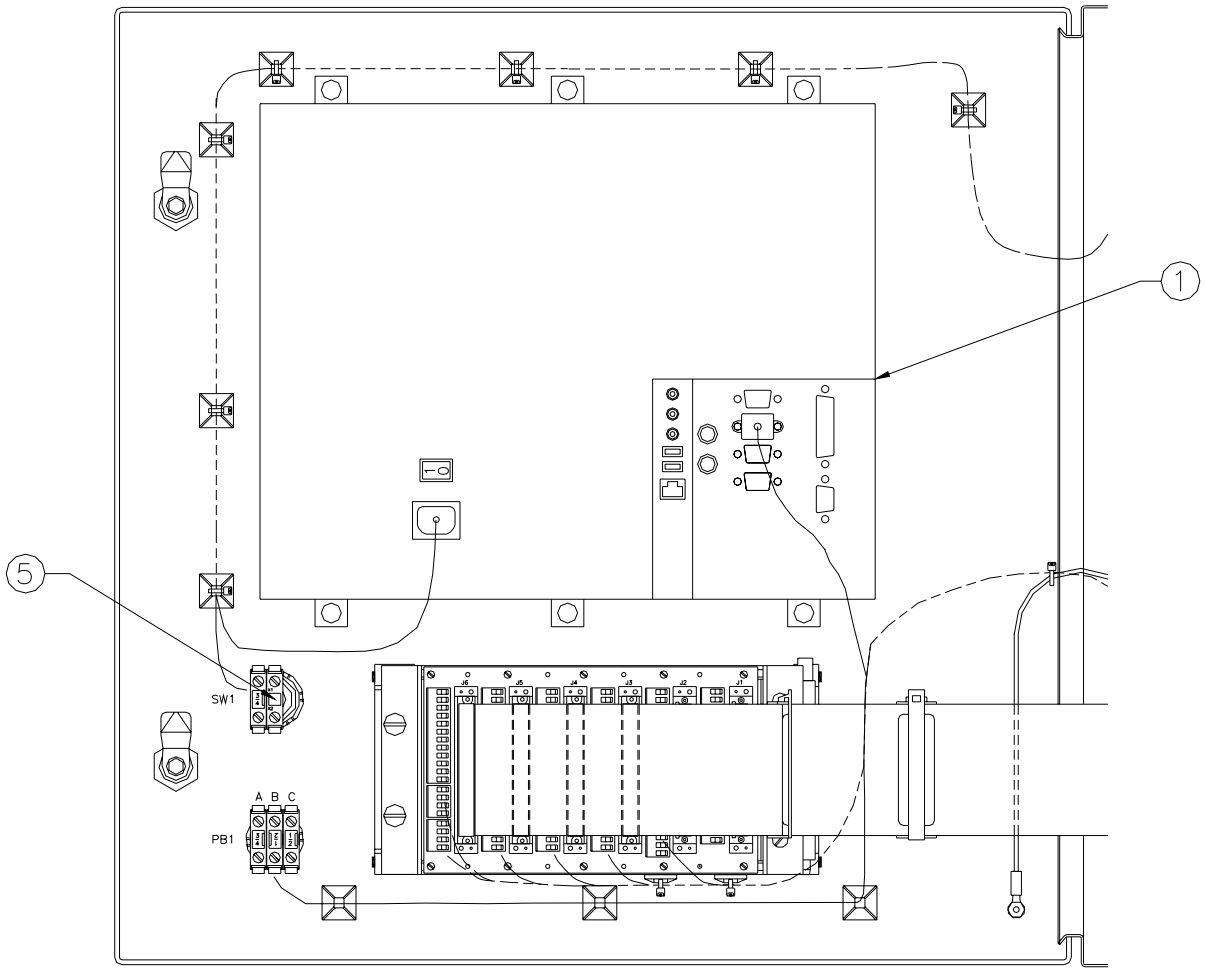


Figure 2: DynaFlow Door (77376 Version)

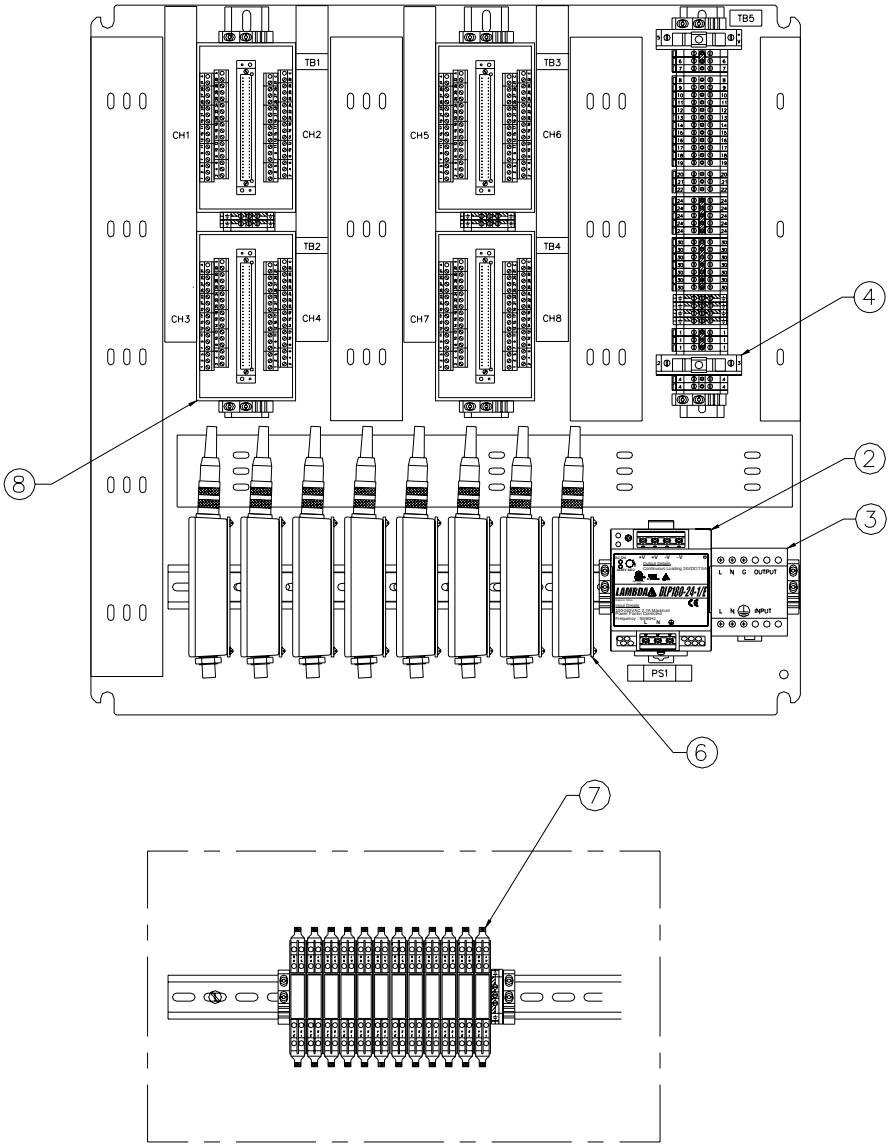


Figure 3: DynaFlow Sub-Panel (77376 Version)

DYNAFLOW PARTS LIST (Figures 2 & 3)

Item #	Part #	Description
N/A	77376-WXYZV *	DynaFlow Control Panel
1	A10705-00	CPU Sub-Assembly
2	A11224-00	Power Supply Assembly, 24 VDC
3	A10577-XX	Power Line Filter
4	4131-11	Fuse, 3AG, 3A
5	74300-00	Bulb, 130 VAC
6	77454-00	Fiber Optic Receiver Assembly
7	73837-08	Intrinsic Safety Barrier
8	77382-00	Ribbon Cable Interface

* PARTS LIST REFERENCE TABLE "W" (# CHANNELs)

Dash No.	Description
2	2 CHANNEL
4	4 CHANNEL
6	6 CHANNEL
8	8 CHANNEL

* PARTS LIST REFERENCE TABLE "X" (E/P Interface)

Dash No.	Description
0	None (Automatic Applications)
1	Interface Connections (Manual GUN Applications)

* PARTS LIST REFERENCE TABLE "Y" (Allen Bradley RIO)

Dash No.	Description
1	RIO

* PARTS LIST REFERENCE TABLE "Z" (Flow Meter Interface)

Dash No.	Description
0	Fiber Optic
1	Intrinsic Safety Barrier

* PARTS LIST REFERENCE TABLE "V" (Voltage)

Dash No.	Description
0	115VAC
1	230VAC

The following DynaFlow spare parts lists **DO NOT** include auxiliary fluid control/monitoring equipment such as pneumatic interface panels, fluid panels, transducer panels, etc. The spare parts lists for the auxiliary equipment should be derived from previous fluid control lists since their usage and requirements are the same.

DYNAFLOW SPARE PARTS LIST

Part No.	Description	Total # of Consoles			Notes
		1-2	3-4	5+	
77377-02	DynaFlow Interface Module	1	2	2	
A10946-00	DynaFlow Channel Card	1	2	3	
77378-00	DynaFlow Mother Board	0	0	1	
A11224-00	Power Supply Assembly, 24 VDC	1	1	1	
73837-08	Intrinsic Safety Barrier	1	1	2	For 77376-XXXX only
77454-00	Fiber Optic Flow Meter Receiver	1	1	2	For 77376-XXXX only
77382-00	Ribbon Cable Adapter	0	1	1	
74300-00	Bulb, 130 VAC	1	2	2	
4131-11	Fuse, 3 AG, 3 AMP	1	2	2	

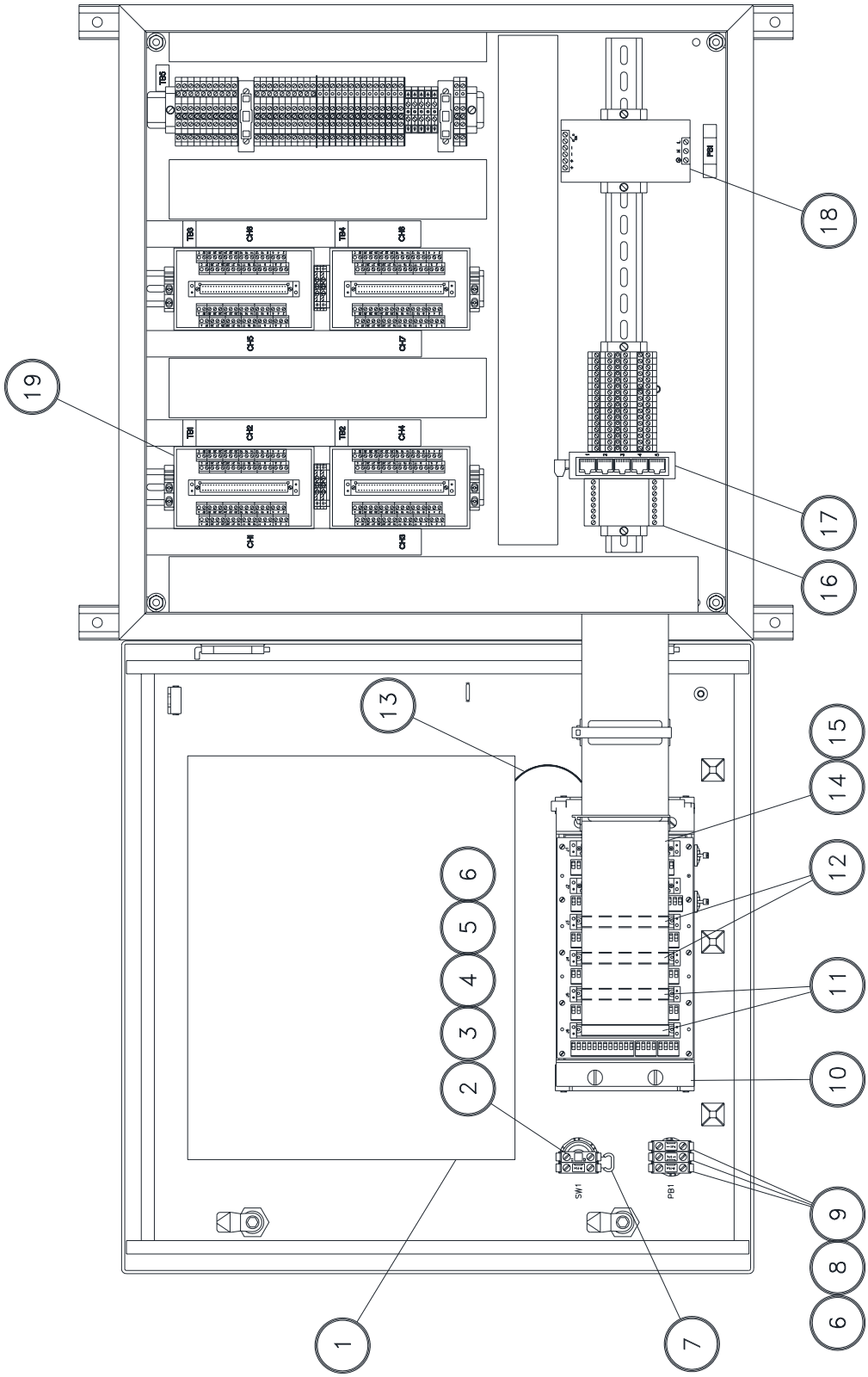


Figure 4: DynaFlow Door (A12233 Version)

DYNAFLOW DOOR PARTS LIST (A12233 Version)		
Item #	**Part #**	**Description**
1	A10705-01	Touch Screen PC, DynaFlow
2	76948-00	Switch, Selector, Maintained, Green
3	LSME0005-00	Contact Block, Normally Open
4	22-1108	Pilot Light Block
5	SS7016	Bulb, 130 VDC Power Supply
6	LSME0004-00	Relay Socket
7	8318-38	2.2 K Ohm, 1/4 Watt Resistor
8	77384-00	Switch, Mushroom Head, E-Stop, Red
9	LSME0006-00	Contact Block, Normally Closed
10	77431-12	Rack with Cards, 2-Channel DynaFlow
11	77380-02	Ribbon Cable Assembly, 64-Conductor
12	77380-01	Ribbon Cable Assembly, 64-Conductor
13	77435-00	Serial Cable Assembly
14	A10946-01	Channel Card, DynaFlow, Voltage Output Only
	A10946-02	Channel Card, DynaFlow, Voltage and Current Outputs
15	77377-02	Interface Card, DynaFlow with RIO
16	A12231-00	Diode Module
17	A10998-00	Ethernet Switch, 5 Port
18	A11224-00	Power Supply, 24 VDC, 100-240 VDC in 240W
19	77382-00	64-Pin Ribbon Cable to Discrete Breakout Board

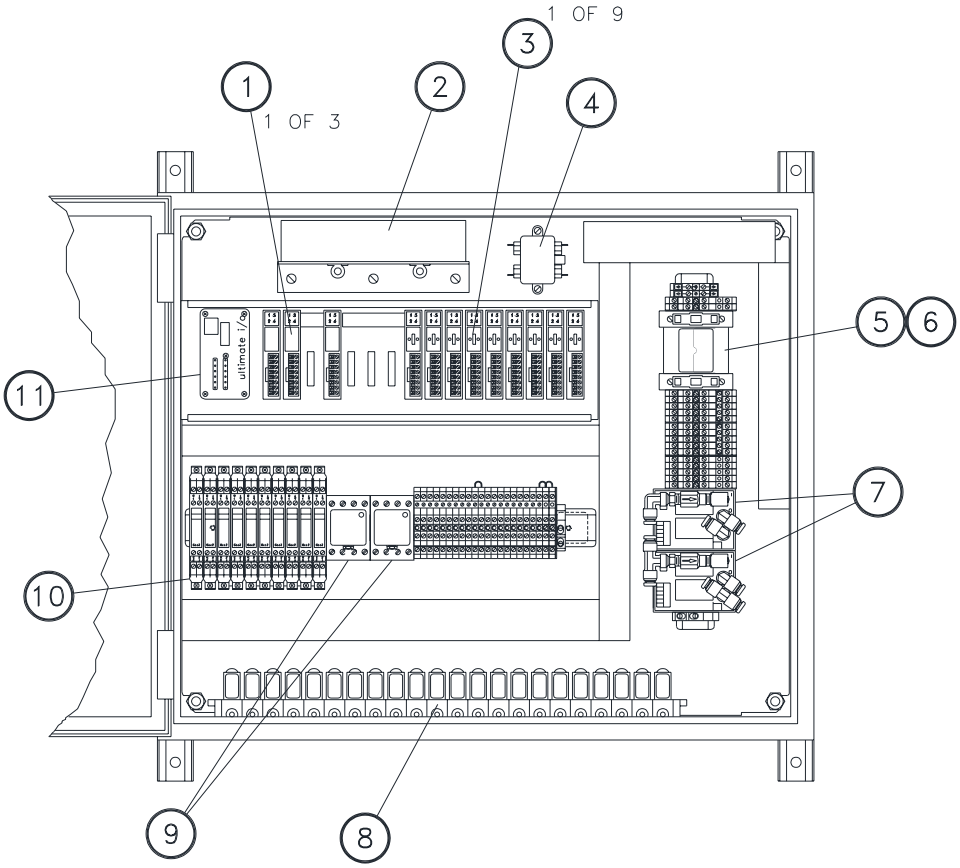


Figure 5: DynaFlow Interface Panel (A12177 Version)

DYNAFLOW INTERFACE PANEL PARTS LIST (A12177 Version)		
Item #	**Part #**	**Description**
1	A10786-00	Output Module
2	A11389-00	Power Supply, +5 VDC, +24 VOD (Used with CC Sequencer)
	78835-00	Power Supply, +24 VDC Only (Used without CC Sequencer)
3	A10787-00	Output Module
4	22-7018	Power Filter
5	SS-7016	12VDC Power Supply
6	TR-SSEH-519	Relay Socket
7	78643-00	Transducer, Voltage to Pressure
8	41-VSO-1005	Solenoid Valve, 24 VDC Coil
9	A12720-00	Fiber Optic Receiver
10	73837-08	Zener Barrier, 24 VDDC @ 50mA
11	A10785-00	Color Change Sequencer Brain

NOTES

WARRANTY POLICIES

LIMITED WARRANTY

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 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.**

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. 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 PURCHASER OR OTHERS.

EXCLUSIONS:

If, in 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.

CONVERSIONS

From	To	Multiply	From	To	Multiply
To	From	Divide By	To	From	Divide By
Volume:	----------	----------	**Weight:**	----------	----------
Gallons (US)	Cubic Centimeters (cc)	3785.00	Kilogram	Pound (lb.)	2.205
Gallons (US)	Liter	3.785	Ton (2000 lb.)	Kilogram	907.18
Gallons (US)	Cubic Meters	.003785	Ounce	Gram	28.349
Gallons (US)	Cubic Inches	231.00	Pound	Gram	453.59
Gallons (US)	Gallon (Imp)	.83268	----------	----------	----------
Quarts (US)	Liter	.946	**Length:**	----------	----------
Fluid Ounces (US)	Cubic Inches	1.8047	Meter	Inches	39.37
Fluid Ounces (US)	Cubic Centimeters (cc)	29.574	Feet	Meter	3048
Liter	Cubic Meters	.001	Inches	Millimeters	25.4
Liter	Cubic Centimeters (cc)	1000.00	Inches	Centimeters	2.54
Liter	Cubic Inches	61.024	Mil (thickness)	Millimeters	.0254
----------	----------	----------	Mil (thickness)	Inches	.001
Velocity:	----------	----------	Yards	Meters	.9144
Feet/Min.	Meter/Min.	.3048	Microns	Meters	.000001
Feet/Sec.	Meter/Sec.	3048	Microns	Mils	.04
Feet/Min.	Inches/Sec.	.200	Mils	Microns	25.4
Feet/Min.	Mile/Hr.	.011364	----------	----------	----------
----------	----------	----------	**Torque:**	----------	----------
Area:	----------	----------	Ft. Lbs.	In. Lbs.	12.00
Square Inches	Square Centimeters	6.452	Newton Meter	In. Lbs.	8.85
Square Centimeters	Square Feet	.001076	Gram Centimeter	In. Lbs.	.00087
Square Feet	Square Meters	.0929	----------	----------	----------
Square Yards	Square Meters	.836	**Pressure:**	----------	----------
Square Feet	Square Yards	.111	Bar (atmosphere)	PSI	14.696
----------	----------	----------	Inches HG	PSI	.4912
Flow:	----------	----------	Inches Water	PSI	.03613
Gallons/Min.	Liter/Min.	3.785	Lbs./Sq. In.	Kg./Sq. cm	.07
Gallons/Min.	Cubic Meters/Sec.	.00006309	----------	----------	----------
Cubic Feet/Sec.	Cubic Meters/Sec.	.028317	**Temperature:**	----------	----------
Cubic Feet/Min. (cfm)	Cubic Meters/Hr.	1.699	ºF	ºC	ºC=9(ºF-32)÷1.8
Liters/Hour	Cubic Feet/Min. (cfm)	2.118	ºC	ºF	ºF=(1.8xºC)+32

RATIO CONVERSION CHART	
% of Catalyst to Total Volume	**Parts of Resin to 1 Part Catalyst**
1	99
2	49
3	32.33
4	24
4.76	20
5	19
6.25	15
9.09	10
10	9
11.11	8
12.5	7
14.28	6
15	5.67
16.67	5
20	4
25	3
30	2.33
33.33	2
35	1.86
40	1.5
45	1.22
50	1

Formula for converting percentage of catalyst to parts of resin:

$$\frac{100\%}{\%\ \text{of Catalyst}} - 1 = \text{Parts Resin to 1 Part Catalyst}$$

Example: 5% catalyst is specified

$$\frac{100\%}{5\%} - 1 = 20\ \text{Parts Resin to 1 Part Catalyst}$$

Formula for converting "parts" to percentage:

$$\frac{100\%}{(\text{Parts Resin} + 1)} = \%\ \text{of Catalyst}$$

Example: If a ratio setting is 13 (13 parts resin to 1 part catalyst), and I want to know what percentage of the total mixed material is resin and what percentage is catalyst.

$$\frac{100\%}{(13 + 1)} = 7.14\%\ \text{Catalyst}$$

100% - 7.14% = 92.86% Resin

MANUAL CHANGE SUMMARY

This manual was published to replace Service Manual **LN-9401-00.4**, *DynaFlow Operator Interface*, to make the following changes:

1. Added "Model A12233" to Front Cover.

"Introduction" Section:

2. Revised "Description".

3. Revised "Specifications".

4. New "Figure 1a - Wiring for Intrinsically Safe Flow Meters (77376)".

5. New "Figure 1b - Wiring for Intrinsically Safe Flow Meters (A12233 Version)".

6. New "Figure 1c - System Connections (77376)".

7. Added "Figure 1d -Input Power Schematic".

"Operation" Section:

8. Revised "Screens - Main Screen".

9. Added "Job Totals in Screens".

10. Added "Color Change in Screens".

11. Removed "Operating the DynaFlow Software from a PC".

12. Revised "Parameter Locations".

13. Revised "Screen Menu Tree".

14. Added "Figure 4 - DynaFlow Door (A12233 Version)".

15. Added "Figure 5 - DynaFlow Sub Panel (A12233 Version)".

16. Removed "Appendix - Paint and Solvent Specifications, Viscosity Conversion Charts, and Volumetric Content of Hose or Tube (English and Metric Units)".

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

Manufacturing

1910 North Wayne Street
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Telephone: 260/665-8800
Fax: 260/665-8516
www.itwransburg.com

Technical/Service Assistance

Automotive Assembly and Tier I	Telephone: 800/ 626-3565	Fax: 419/ 470-2040
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.

ISO 9001 Quality Systems

ENVIRONMENTALLY CONCERNED

Form No. LN-9401-00.5
Litho in U.S.A.
03/12