TRICONTINENT™
HANDLING LIQUIDS...PRECISELY

MC6000 MULTI-CHANNEL SYRINGE PUMP

OPERATION AND MAINTENANCE MANUAL

8694-14 E

CONTENTS

INTRODUCTION

MC6000 INTRODUCTION

The MC6000 is a precision OEM multi-channel pump module designed for use with automated instrumentation. All typical aspiration and dispensing operations expected from an OEM multi-channel module can be accomplished with this unit. The stepper motor driven syringe will accurately and precisely handle fluids from 5 μL to 5 mL. Standard resolution is 6,000 steps per full syringe stroke and can be set into Hi-Res mode providing 48,000 steps. Other resolutions are configurable for backwards compatibility.

An MC6000 is ideal for experienced instrument manufacturers who are looking to maximize the investment they have already made in existing instrumentation, by using the MC6000 as a direct replacement for the competitive product. This pump utilizes standard communication protocols and mounting configurations used by other multi-channel pump designs, thereby eliminating the need to perform expensive and time consuming re-development.

This manual was created specifically for the use of instrument designers with the knowledge of existing firmware of similar designs or those looking to upgrade and/or retrofit existing applications. In order to make your product transition quick and simple, a Quick Start Guide is included in this manual that illustrates only those areas that are unique to the TriContinent MC6000.

For those customers that are just being introduced to the MC6000 design, this manual includes basic information you will require to get started. However, a complete MC6000 Multi-Channel Syringe Pump Software Manual is available upon request.

MC6000 Multi-Channel Precision Pump Module

QUICK START CONFIGURATION GUIDE
(for replacing an XL3008/XMP3008/XMP6008)

Configuration Jumpers

The MC6000 has the configuration jumpers located in different locations (see figure on back). The functions of the jumpers are also slightly different. Please see below for jumper settings compared to XL3008, XMP3008, and XMP6008:

Function	MC6000[1]	XL3008	XMP[1]	Action
Protocol[2]	N/A	SW2-2	N/A	ON = OEM
Reserved	N/A	SW2-3	N/A	Reserved
RS232/USB[3]	J2-1	N/A	N/A	Installed = RS232
EEPROM Mode	J2-2	N/A	N/A	Installed = Autostart
Overload Detection	J2-3	SW2-1	N/A	Installed/On = Disabled
RS232 Communication Rate[4]	J2-4	SW2-4	N/A	Installed/On = 38.4 K/125 K

Note 1 - The MC6000 and XMP use software configuration settings.
Note 2 - The MC6000 and XMP have automatic protocol detection.
Note 3 - The MC6000 provides RS232 or USB for PC connection.
Note 4 - The XL3008 and XMP3008 do not have a CAN interface.

Rs485 and CAN Termination Jumpers

The MC6000 has the configuration jumpers located in different locations (see figure on next page). Pumps are shipped with termination jumpers installed. Remove them if not needed.

Function	MC6000	XL3008	XMP3008	XMP6008	Action
RS485A	J9-1	JP7,1-2	J4,1-2	J1,1-2	Installed = Terminated
RS485B	J9-2	JP7,3-4	J4,3-4	J1,3-4	Installed = Terminated
CAN	J9-3	N/A	N/A	N/A	Installed = Terminated

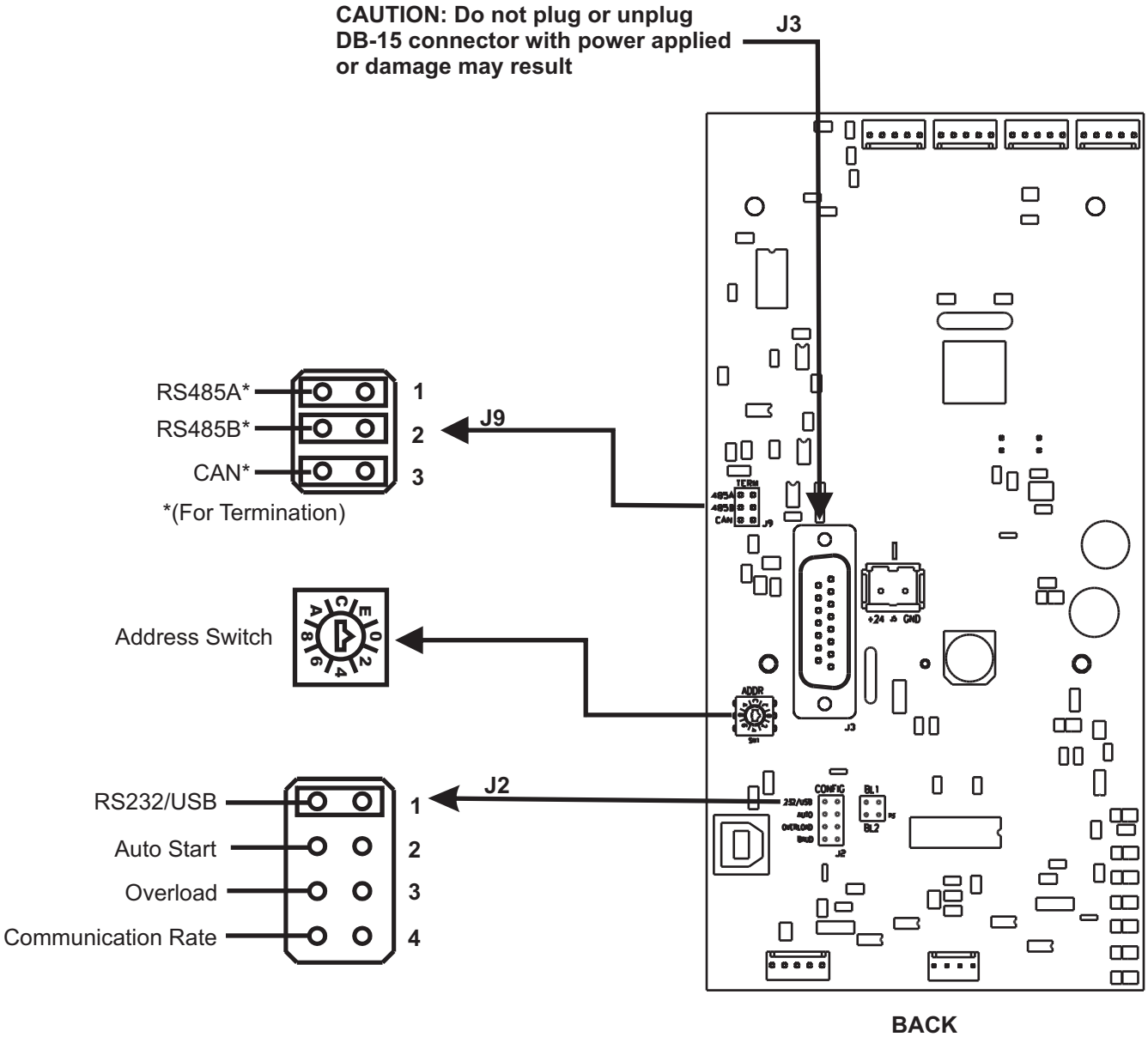
Software Compatibility

The MC6000 is 100% compatible with the XL and XMP protocols and documented command set. There are some commands and responses that are different as shown below:

Command	Value	Description	Difference
^	< n > 0..255	Sets threshold value for fluid detection	NA for MC6000[1]
z	none	Set position count to encoder count	NA for MC6000[1]
?4		Report actual position of plunger	NA for MC6000[1]
?22		Report current value from fluid sensor	NA for MC6000[1]
&		Report firmware version	New response[2]
#		Report firmware checksum	New response[2]

Note 1 - The MC6000 does not include a valve fluid detector circuit or a high resolution encoder. These commands are accepted, but are not functional.
Note 2 - The MC6000 has different electronics and firmware. These report commands will respond with the same amount of characters, but with different response data.

QUICK START CONFIGURATION GUIDE
(MC6000 Jumper Locations)



SPECIFICATIONS

Downloadable specifications can be found on the TriContinent website at www.tricontinent.com.

MC6000 Multi-Channel Pump Data Sheet	3 pages	MKT90022 pg01.pdf

HARDWARE

J3 Mating Connectors

Manufacturer	Description	Manufacturer's P/N
AMP	15 pin female-solder cup,receptacle	747909-2
Cinch	15 pin female-solder cup,receptacle	DA-155
AMP	Plastic shield w/male screw retainers	207908-4
Cinch	Plastic shield w/male screw retainers	SDH-15GL-CS

J3 Wiring

Power and communication is supplied via a single cable to the MC6000.

Pin	Function	Details
1	24 VDC	See Below
2	RS232 TxD line	Output Data
3	RS232 RxD line	Input Data
4	+5 VDC	100mA Output
5	CAN HI Signal line	
6	CAN LO Signal line	
7	AUX Input #1	TTL Level (4.7K ? pullup)
8	AUX Input #2	TTL Level (4.7K ? pullup)
9	Ground	Power and Logic
10	Ground	Power and Logic
11	RS485 A line	
12	RS485 B line	
13	AUX Output #1	TTL Level (1K ? pullup Max Source/Sink current = ±20mA)
14	AUX Output #2	TTL Level (1K ? pullup Max Source/Sink current = ±20mA)
15	AUX Output #3	TTL Level (1K ? pullup Max Source/Sink current = ±20mA)

CAUTION: Do not plug or unplug DB-15 connector with power applied or damage may result.

Note: A DB15 to card edge converter module is available for existing XL3008 users.

Power Supply Requirements

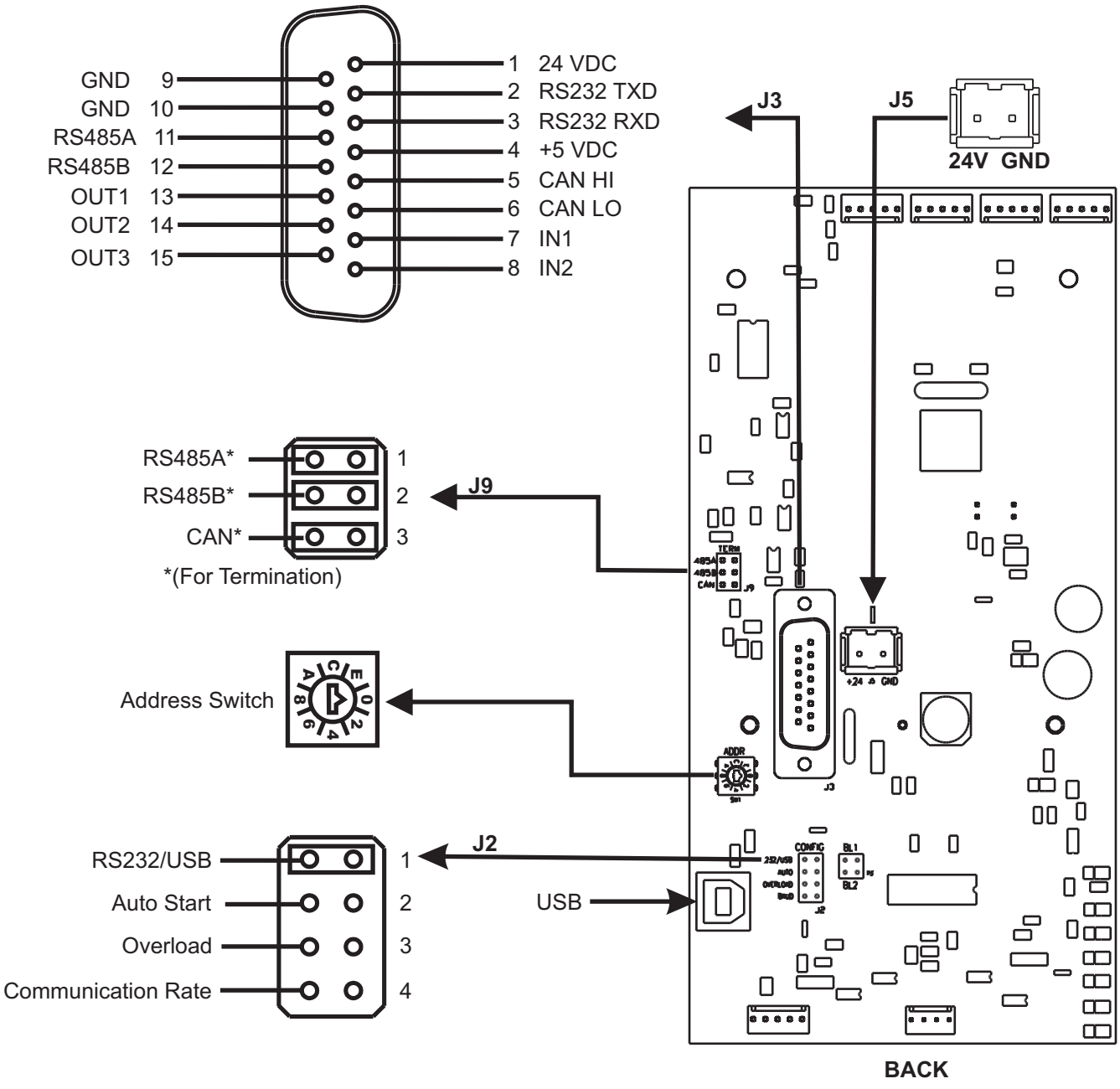
Linear or switching supplies may be used.

Output Voltage	24 VDC Nominal +/-10%
Output Current	≥ 2.5 A Peak

Fluid Connectors

The MC6000 has 1/4-28” fittings as the standard configuration.

ELECTRICAL CONNECTOR LOCATIONS



CONFIGURATION JUMPER AND SWITCH SETTINGS

J2

Jumper	Function	Jumper Installed	Jumper Removed
J2-1	RS232/USB Select	RS232	USB
J2-2	EEProm Autostart	Enabled	Disabled
J2-3	Plunger Overload	Disabled	Enabled
J2-4	Communication Rate	38,400 Baud (RS232/485) 125 K CAN	9,600 Baud (RS232/485) 100 K CAN

J9

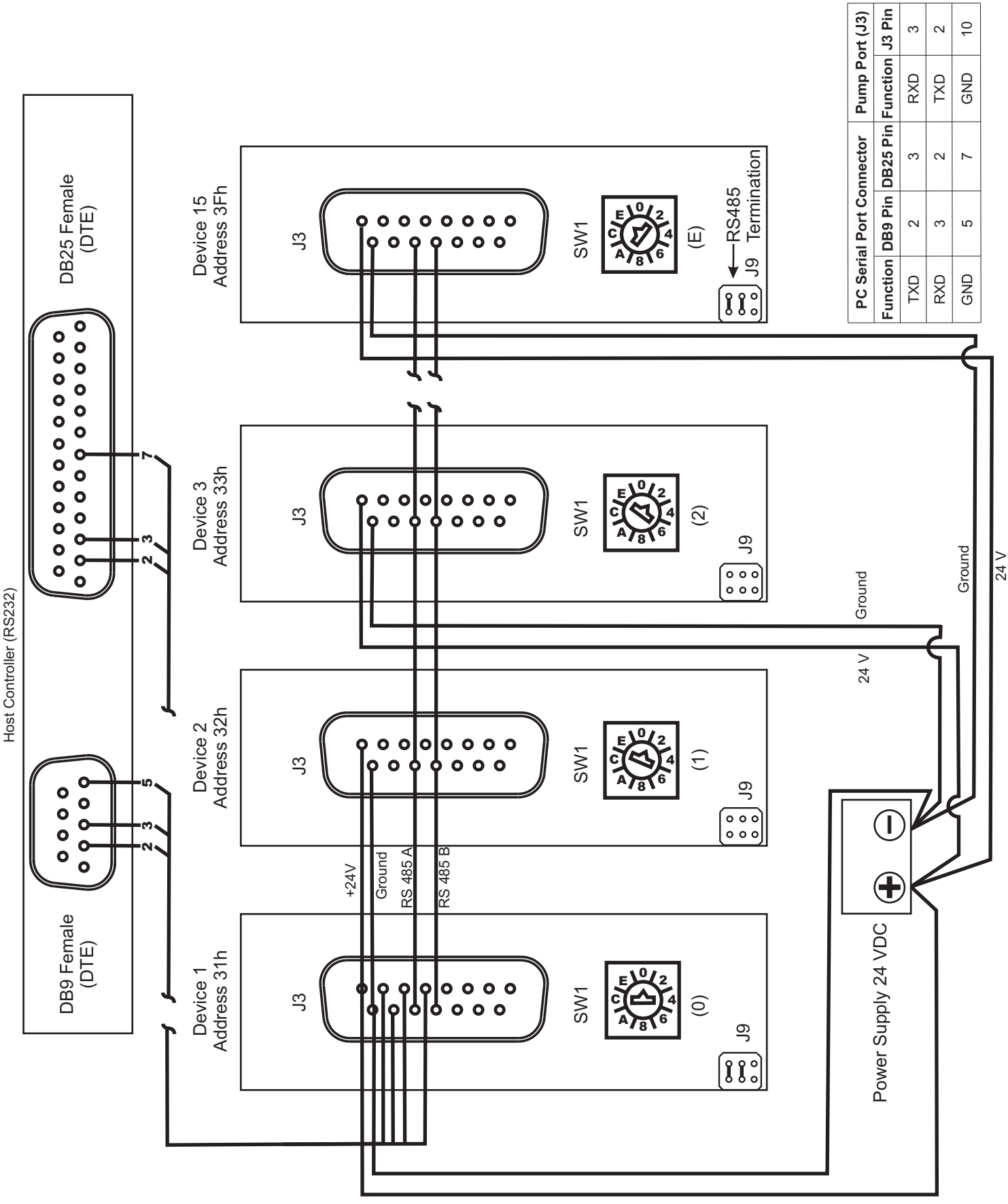
Jumper	Function	Jumper Installed	Jumper Removed
J9-1	RS485 Termination A	Terminated	Not Terminated
J9-2	RS485 Termination B	Terminated	Not Terminated
J9-3	CAN Termination	Terminated	Not Terminated

ADDRESS SWITCH

The address switch is used to provide each MC6000 a unique address in a multi-channel application. The address switch has 16 locations (0-E). The F address location is used to activate the self-test. The address locations can be set by using a small flathead screwdriver and rotating the switch in either direction to the appropriate address.

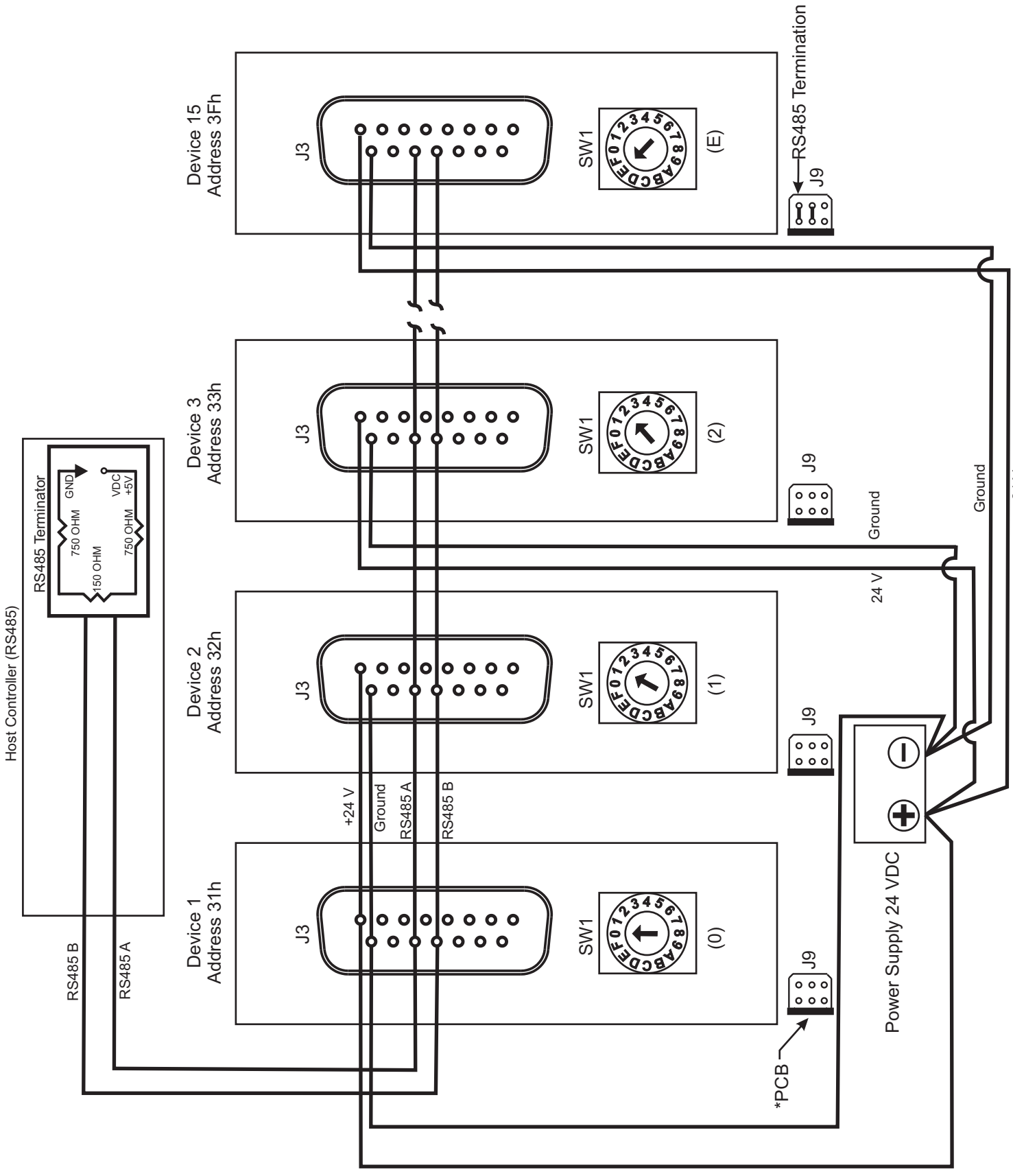
Address Switch

RS232 CABLING DIAGRAM

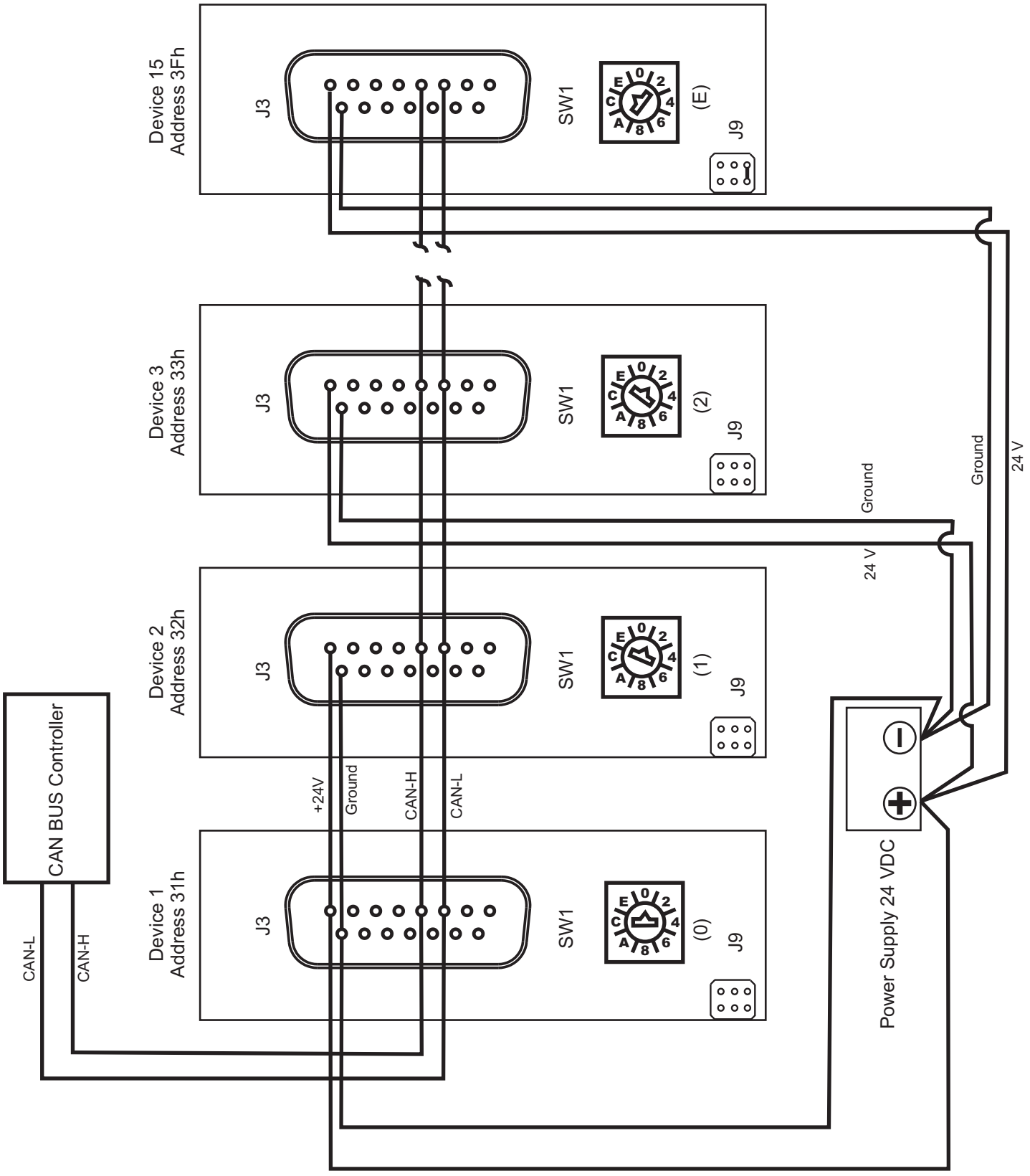


PC Serial Port Connector			Pump Port (J3)	
Function	DB9 Pin	DB25 Pin	Function	J3 Pin
TXD	2	3	RXD	3
RXD	3	2	TXD	2
GND	5	7	GND	10

RS485 CABLING DIAGRAM



CAN CABLING DIAGRAM



RS232 AND RS485 COMMAND SUMMARY

Control Commands

Command	Operand Range <n>	Default Operand	Power Up Default	Operand Description	Command Description
R	N/A	N/A			Execute command string
y<n>	0…3	N/A		<0> - Execute if Input2 is Low and Input1 is Low <1> - Execute if Input2 is Low and Input1 is High <2> - Execute if Input2 is High and Input1 is Low <3> - Execute if Input2 is High and Input1 is High	Execute next command in buffer based on Aux inputs
X	N/A	N/A			Re-execute last executed command string
G<n>	0…30000	0		0 = loop forever	Repeat command sequence
g	N/A	N/A			Mark the start of a repeat sequence
M<n>	0…30000	N/A		milliseconds	Delay command execution
H<n>	0-2	0		<0> - Wait for [R] or either input 1 or 2 to go low <1> - Wait for [R] or input 1 to go low <2> - Wait for< [R] or input 2 to go low	Halt command execution
T	N/A	N/A			Terminate command

Initialization Commands

Command	Operand Range <n>	Default Operand	Power Up Default	Operand Description	Command Description
Z<n>	0,10…40	0		<0> or no arg, default initialization speed <10-40> initialize at defined plunger speed	Initialize plunger, valve to the right
Y<n>	0,10…40	0		<0> or no arg, default initialization speed <10-40> initialize at defined plunger speed	Initialize plunger, valve to the left
W<n>	0,10…40	0		<0> or no arg, default initialization speed <10-40> initialize at defined plunger speed	Initialize plunger without valve
z<n>	0…6000	0			Set pump's internal position counter to value specified
k<n>	0…255		122		Syringe dead volume command
x<n>	25 ..100		100		Set initialization force as a percentage of the maximum force
J<n>	10…40			XL mode only	Set initialization speed

RS232 AND RS485 COMMAND SUMMARY

Plunger Movement Commands

Command	Operand Range <n>	Default Operand	Power Up default	Operand Description	Command Description
A<n>	0...6000	0			Move plunger to absolute position
a<n>	0...6000	0			Move plunger to absolute position; Not busy
P<n>	0…6000	0			Relative pickup
p<n>	0...6000	0			Relative pickup; Not Busy
D<n>	0...6000	0			Relative dispense
d<n>	0...6000	0			Relative dispense; Not busy

Valve Commands

Command	Operand Range <n>	Default Operand	Power Up Default	Operand Description	Command Description
I	N/A	N/A			Move all valves to Input position
O	N/A	N/A			Move all valves to Output position
B	N/A	N/A			Move all valves to Bypass position
B<n>	0000...1111	N/A			Move each valve pair to the input or output position defined by the binary argument
E<n>	0..255	N/A			Move each valve pair to the input or output position defined by the exponential argument

Set Commands

Command	Operand Range <n>	Default Operand	Power Up Default	Operand Description	Command Description
K<n>	0…255	0	48		Backlash steps
L<n>	1...20		7		Set acceleration/deceleration slope
v<n>	0...1000		901		Set start velocity in Hz
V<n>	1...6000		901		Set top velocity in Hz
S<n>	0...40				Set speed
c<n>	1...2700		901		Set cutoff velocity in Hz
h<n>	0...100		10		Set motor hold current in %
m<n>	0...100		100		Set motor run current in %
N<n>	0...2		0	<0> = normal mode <1> = microstep position mode <2> = microstep position and velocity mode	
J<n>	0...7			0 = all outputs Low 7 = all outputs High	Sets the 3 TTL auxiliary outputs
j<ppppn>	<pppp> 1...6000			<pppp> = syringe position <n> = auxillary outputs	Sets the 3 auxiliary outputs based on syringe position

RS232 AND RS485 COMMAND SUMMARY

EEPROM Commands

Command	Operand Range <n>	Default Operand	Power Up Default	Operand Description	Command Description
s<n>	0...14				Load program string into EEPROM
e<n>	0...14				Execute EEPROM string
><n1><n2>	<n1> 0..15 <n2> 0..255				Store user data <n2> at specified location <n1>
U30	N/A				Sets auto run
U31	N/A				Clears auto-run
u_	0...14			For factory use only	Set system configuration parameter into EEPROM
!	N/A				Load EEPROM settings

Report Commands

Command	Operand Range <n>	Default Operand	Power Up Default	Operand description	Command Description
Q	N/A	N/A			Report system status
?	N/A	N/A			Report absolute plunger position
?0	N/A	N/A			Same as ?
?1	N/A	N/A			Report start velocity in Hz
?2	N/A	N/A			Report peak velocity in Hz
?3	N/A	N/A			Report cutoff velocity
?4	N/A	N/A			Report plunger position, same as ?
?5	N/A	N/A			Same as ?
?6	N/A	N/A			Reports Valve Position
?7	N/A	N/A			Reports Acceleration slope set with [L]
?10	N/A	N/A			Report Command Buffer Status, same as F
?12	N/A	N/A			Report number of backlash steps
?13	N/A	N/A			Report Status of Aux 1 input
?14	N/A	N/A			Report Status of Aux 2 input
?15	N/A	N/A			Non- Functional, Will always report 1
?16	N/A	N/A			Non- Functional, Will always report 1
?17	N/A	N/A			Non- Functional, Will always report 1
?18	N/A	N/A			Number of valve movements since last ?18, same as %
?19	N/A	N/A			Reports 1 if pump is initialized, 0 otherwise
?20	N/A	N/A			Report firmware checksum, same as #
?21	N/A	N/A			Reports plunger hold current as a percentage
?22	N/A	N/A			Reports plunger run current as a percentage
?23	N/A	N/A			Report firmware version, same as &
?24	N/A	N/A			Report the syringe's dead volume as set by the [k] command

RS232 AND RS485 COMMAND SUMMARY

Report Commands

Command	Operand Range <n>	Default Operand	Power Up Default	Operand description	Command Description
?26 or *	N/A	N/A			Reports +24V
?27	N/A	N/A			Reports configuration EEPROM data as set using the [u] command
?28	N/A	N/A			Reports syringe motor step mode
?30 - ?44					Reports user EEPROM execution strings, ?30 = s0, ?31 = s1 and so on
?45	N/A	N/A			Reports alpha-numeric value
?76	N/A	N/A			Same as ?27
F	N/A	N/A			Report Command buffer status, same as ?10
&	N/A	N/A			Report firmware version, same as ?23
#	N/A	N/A			Report firmware checksum, same as ?20
< <n>	0 ..15	N/A			Reports user stored data.
%	N/A	N/A			Number of valve movements since last report, same as ?18

CAN BUS COMMAND SUMMARY

Report Commands
Frame Type = 6

Command	Operands	Command Description
0	N/A	Plunger position
1	N/A	Reports encoder position, like ?4
2	N/A	Same as Report Command 0
3	N/A	Reports valve position, like ?6
4	N/A	Top velocity, like ?2
6	N/A	Start Velocity, like ?1
7	N/A	Cutoff Velocity, like ?3
10	N/A	Buffer status, like ?10
12	N/A	Backlash steps, like ?12
13	N/A	Input 1 status, like ?13
14	N/A	Input 2 status, like ?14
15	N/A	Number of pump initializations, like ?15. Note, currently not implemented, always returns a 1.
16	N/A	Number of plunger movements, like ?16, Note, currently not implemented, always returns a 1.
17	N/A	Number of valve movements, like ?17. Note, currently not implemented, always returns a 1.
18	N/A	Number of valve movements since last report, like ?18
20	N/A	Firmware checksum, like ?20
22	N/A	Non-functional command to maintain backward firmware compatibility. Always returns 255, like ?22
23	N/A	Firmware version, like ?23
24	N/A	Syringe dead volume, like ?24
29	N/A	Current status, like Q

CAN BUS COMMAND SUMMARY

On-the-fly Commands
Frame Type = 0

Command	Operands	Command Description
V	Same as RS232/485	Top velocity
T	N/A	Terminate

Action Commands
Frame Type = 1

Command	Operands	Command Description
		All RS232/485 commands, With the exception of Report commands, are valid Action commands in CAN mode

Common Commands
Frame Type = 2

Command	Operands	Command Description
0	N/A	Reset mode
1	N/A	Start Loaded command
2	N/A	Clear Loaded command
3	N/A	Repeat last command, like X
4	N/A	Stop action immediately. Same as T command

MAINTENANCE

RECOMMENDED MAINTENANCE

Daily Maintenance	Action
Inspect syringe seals and valves for leaks and proper operation.	Replace as required.
Inspect tubing fittings for leaks.	Tighten or replace as required
Inspect for any fluid or material on outside of pump.	Clean as required
"Park" inactive syringes.	Flush with DI water at end of use and "park" syringe full of system fluid in full down position.

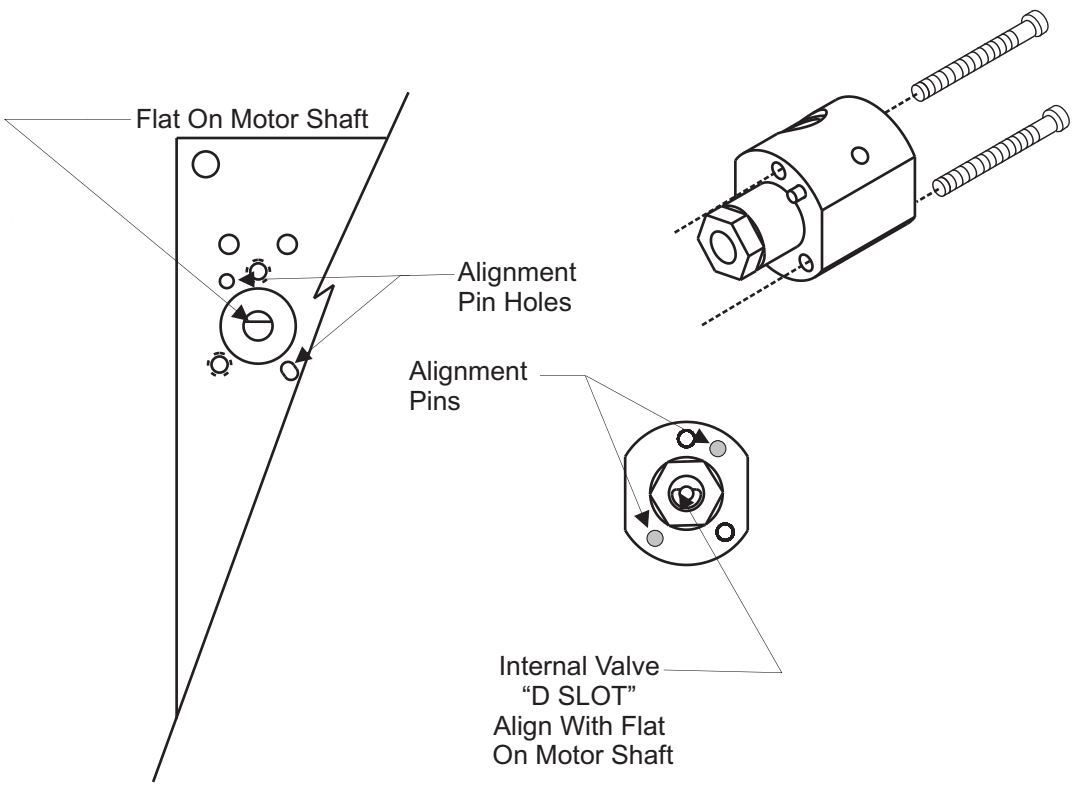
VALVE REPLACEMENT

To replace the valve, prime all fluid from the syringe, and follow the steps below:

1. Remove syringe as described in steps 1 - 3 on page 19.
2. Disconnect the tubing from the valve.
3. Remove the two valve screws used to secure the valve to the panel.
4. Remove the valve from the pump.

To install the valve follow the below steps:

5. Align internal valve “D” slot with the flat on the motor shaft.
6. Gently push and rotate the valve into the correct position to align the pins with the holes in the panel.
7. Securely tighten (clockwise) the plunger lock screws.
8. Initialize the pump.



SYRINGE REPLACEMENT

To replace the syringe, prime all fluid from the syringe, and follow the steps below:

1. To replace the syringe, lower the plunger driver. If the power is on, this can be done by sending the A3000R command.
2. Turn the plunger lock screw counterclockwise 3 turns.
3. Turn the syringe counterclockwise and remove from the valve.

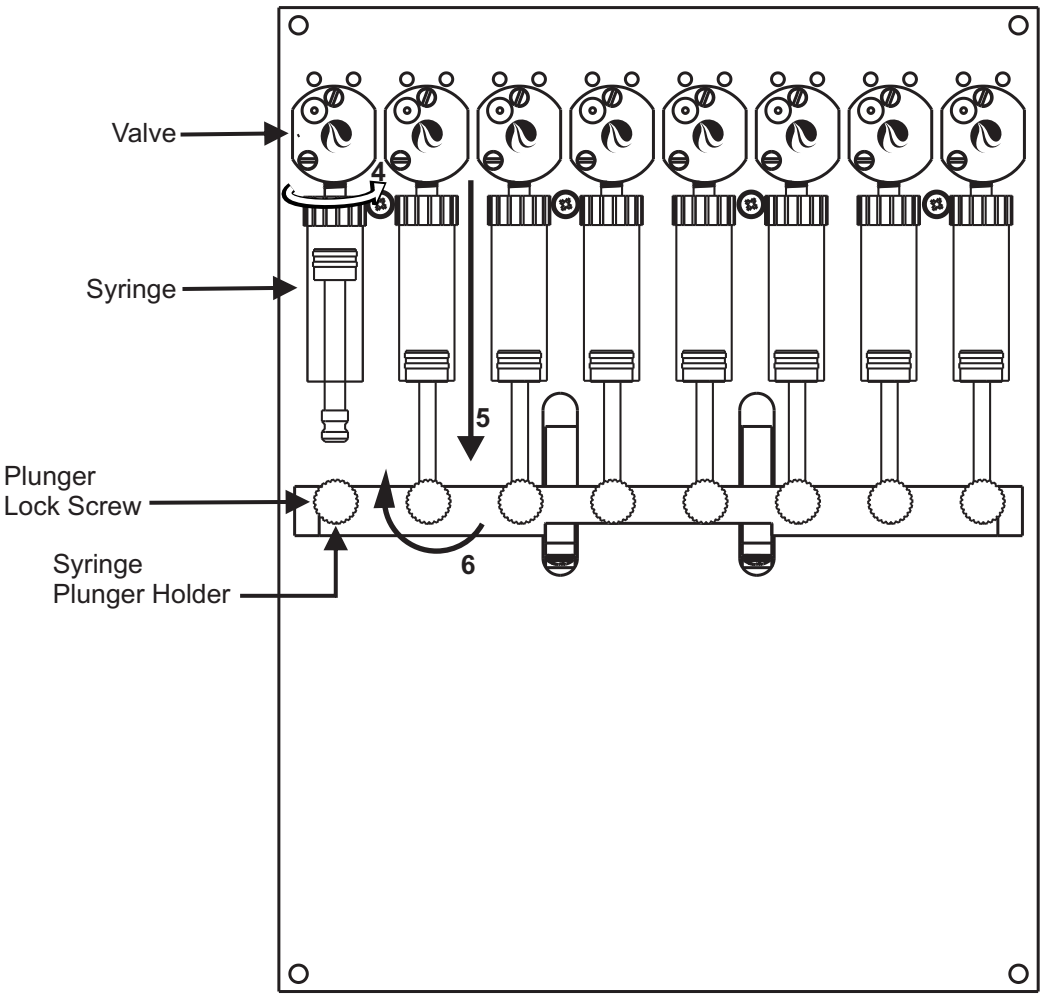
To install the syringe follow the steps below:

4. Screw the threaded portion of the syringe clockwise into the valve. Align barrel plunger to center of hole in the plunger holder.

5. Fully seat the plunger into the syringe plunger holder.

6. Securely tighten (clockwise) the plunger lock screw.

7. Initialize the pump.



ORDERING INFORMATION

ACCESSORIES AND REPLACEMENTS

To view or download Accessories and/or Replacement items available for the MC6000 series, please visit our website at www.tricontinent.com .

ORDERING INFORMATION / CUSTOMER SERVICE

TriContinent is committed to exceeding our customers expectations when it comes to our products and services. To place an order or inquire on the MC6000 series or any TriContinent product, please contact TriContinent at one of the following:
TriContinent, 12555 Loma Rica Drive, Grass Valley, CA 95945
From within the United States, telephone (800) WE-PIPET (800-937-4738)
From outside the United States, telephone (530) 273-8888
FAX (530) 273-2586
E-MAIL liquidhandling@tricontinent.com
WEB www.tricontinent.com

WARRANTY AND RETURNS

TriContinent is an ISO 13485 registered company that operates under a stringent quality assurance program. We design and manufacture our syringe pumps to be the most reliable product available. We stand behind the MC6000 with a **1-year** warranty on material and workmanship, excluding abuse and misuse**.** If notified of such defects during the warranty period, TriContinent will, at its option, either repair or replace products which prove to be defective.

Please refer to the TriContinent website www.tricontinent.com for detailed warranty and return information.