



# **CS-110**

# **Automatic Changeover System**

## **Operation and Maintenance Manual**

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# Hydro Instruments CS-110 Automatic Changeover System

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# SAFETY PRECAUTIONS

**GENERAL:** Be sure to follow all applicable safety precautions when operating this equipment.

**ELECTRICAL:** The circuit board and incoming A/C power line carry the risk of shock and short circuit. Do not touch any part of the circuit board or A/C power line unless you are certain that A/C power has been disconnected from the system.

## I. OVERVIEW

### 1. Contents

This instruction manual describes the Series CS-110 automatic changeover controller and its use in an automatic changeover system. See the circuit board diagram Figure 2.

### 2. General Specifications:

Dimensions: 301mm x 248mm x 128mm  
Power Supply: 100-240 VAC 50/60 Hz  
Power: 10W  
Operating Temperature: -10° C to 50° C  
Ambient Temperature: -10° C to 50° C

<b>Inputs:</b>	3 Optically isolated contact inputs: (1) Remote alarm silence input switch channel (2) Pressure switch contact inputs
	2 Optional 4-20mA inputs for weighing scales
<b>Outputs:</b>	2 AC powered outputs for electronic ball valves
	2 Relays indicating pressure switch condition (normal or low alarm)
	2 Relays indicating valve position (open or closed)
<b>Display:</b>	2 line, 20 character LCD
<b>LED's:</b>	6 LED indicators
<b>Audible Alarm:</b>	90 dB horn

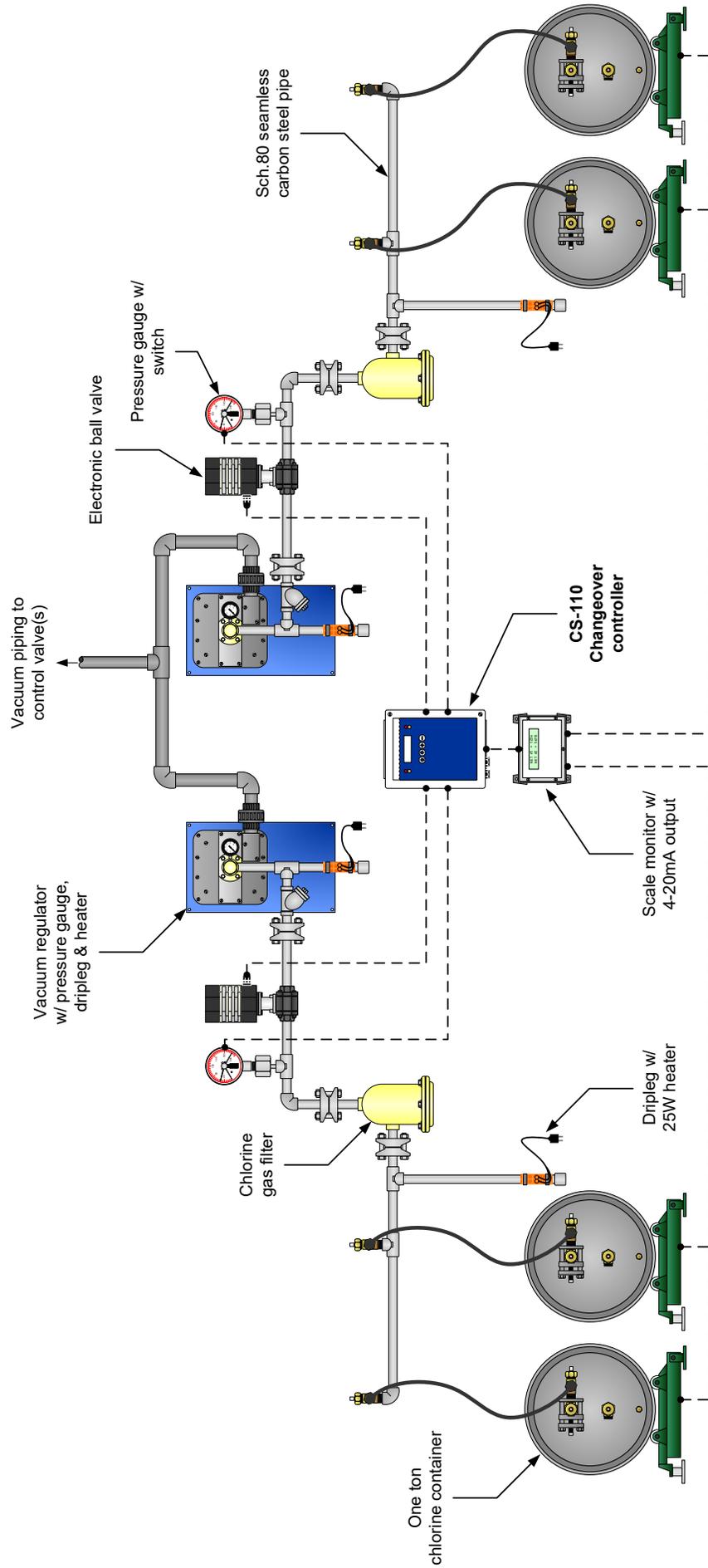
### 3. Functional Overview

This equipment is used to control changeover from working to standby chlorine containers either manually or automatically. The controller accepts two pressure switch signals and provides control signals to operate two electronic ball valves. LEDs and an LCD display indicate the operating conditions of the system. Two 4-20mA input channels are also provided to accept optional weighing scale signals. Figure 1 shows the typical system layout for the Series CS-110 system.

The display indicates the time of day, date of the year, records the length of time that each side of the manifold has been in the working condition (electronic ball valve open) and (optionally) the chemical weight as indicated by weighing scales.. The LEDs indicate which side is in operation and also if one or both sides is empty.

The details of operation are described in Section III below.

**Figure 1—Typical System Installation**



## II. INSTALLATION INSTRUCTIONS

### 1. Electrical Connections

Refer to Figure 2 on the following page for wiring connections on the CS-110 controller circuit board.

### 2. General Description (Refer to Figures 2, 3 and 4)

#### a) AC Power Connections:

Accepts 100 to 240 VAC 50/60 Hz

L1 = Black

L2 = White

GND = Green

#### b) Optional Remote Acknowledge Alarm

Remote Alarm silence input switch (Normally Open). If an alarm condition exists then providing a 12-24VDC signal to this input channel will silence and clear the alarm conditions. The connections should be made to pins DI3+ and DI3-. Remote acknowledge can also be done through Modbus (See Section III.4).

#### c) Pressure Switch

Pressure switch signal input channels are Normally Open (NO).

PS1+ / PS1- = No. 1 container bank pressure switch NO signal input

PS2+ / PS2- = No. 2 container bank pressure switch NO signal input

The pressure switches should be wired to the controller circuit board as shown in Figure 2.

#### d) AC Powered Outputs for Electronic Ball Valves

The powered cables for the two electronically actuated ball valves are pre-wired to the controller and are provided with plug style connectors. Once mechanical installation of the ball valves is complete, simply connect the ball valves to the power cables using the plug-style connectors provided.

*NOTE: Be sure of which valve is selected as Valve No.1 (V1) and which is selected as Valve No.2 (V2).*

#### e) Optional Analog 4-20mA Inputs for Weighing Scales

If ordered with this option, then there will be an additional circuit board provided that can accept two 4-20mA signals (one from a scale on each side of the changeover). For weighing scale #1 the 4-20mA signal + wire should be connected to AI1+ and the – wire should be connected to AI1-. Similarly, for weighing scale #2 the 4-20mA signal + wire should be connected to AI2+ and the – wire should be connected to AI2-.

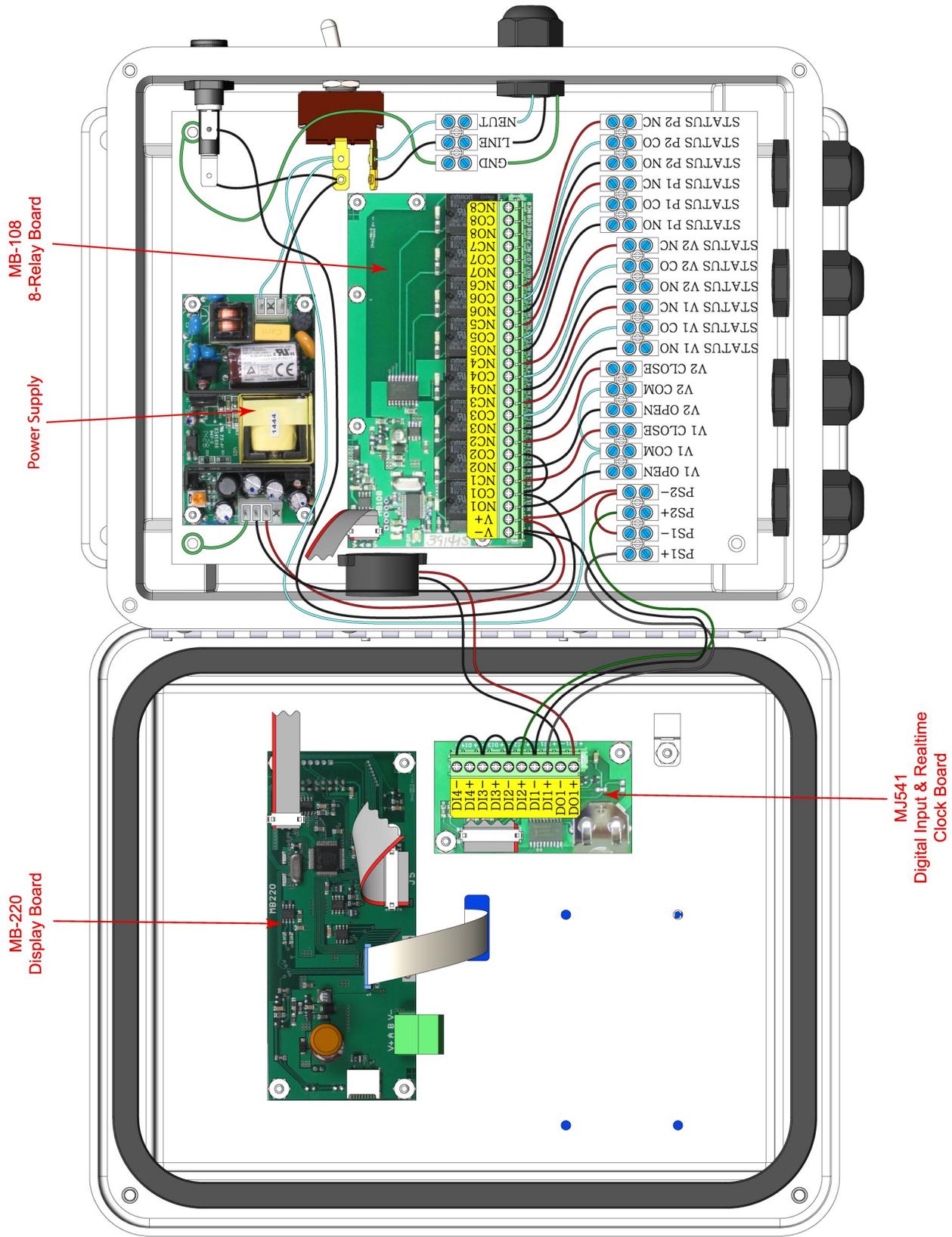
#### f) Relay Outputs Indicating Valve Position

Contact Relay 3 (NO1 & COM) will close upon Valve No.1 (V1) closing and Relay 4 (NO2 & COM) will close upon Valve No.2 (V2) closing.

#### g) Relay Outputs Indicating Pressure Switch Condition

Contact Relay 5 will close upon Switch No.1 (S1) closing and Relay 6 will close upon Switch No.2 (S2) closing. These contacts can be utilized as Normally Open (NO) or Normally Closed (NC).

**Figure 2—CS-110 Internal Wiring Diagram**



### III. OPERATION INSTRUCTIONS

#### 1. Keypad Operation

The keys are used as described below. For more detailed information see Figure 3 and Section III.3.



Automatic/Manual switch key. This key has three functions:

- a. This key is used to manually switch from one container or bank of containers to the other. Pressing this key will manually change from one side to the other.
- b. In the stop state (See Section III.3.f), if the containers are not empty, this key can be used to enter the normal operating mode.
- c. In the configuration mode (Screens 2a through 2f), this key allows the operator to revisit the previous parameter (screen).



Configuration control key. This key is used to enter (via password) and move through the time setting options. Press this key one time to enter the password screen. Enter "110" using the & keys then press this key once to enter the configuration menu. The parameter selected to be adjusted will blink. After making the time adjustments continue to press this key until there no longer is a flashing parameter.



This key has two functions:

- a. In the normal operating mode, pressing this key will close both electronic ball valves. It is used to close the two sides at the same time and then the display will read "OFF".
- b. This key is also used to adjust parameters on screens 2a through 2f.



This key has two functions:

- a. In the configuration mode this key is used to reduce the parameter selected for editing.
- b. When on the main operation screen 1a, this key is used to clear the alarm and to clear the container empty LED. When there is an empty container alarm, press this key the first time to turn off the audible alarm. After changing chlorine containers and opening the cylinder valves, press this key a second time to turn off the empty indication LED and clear the previous time records.

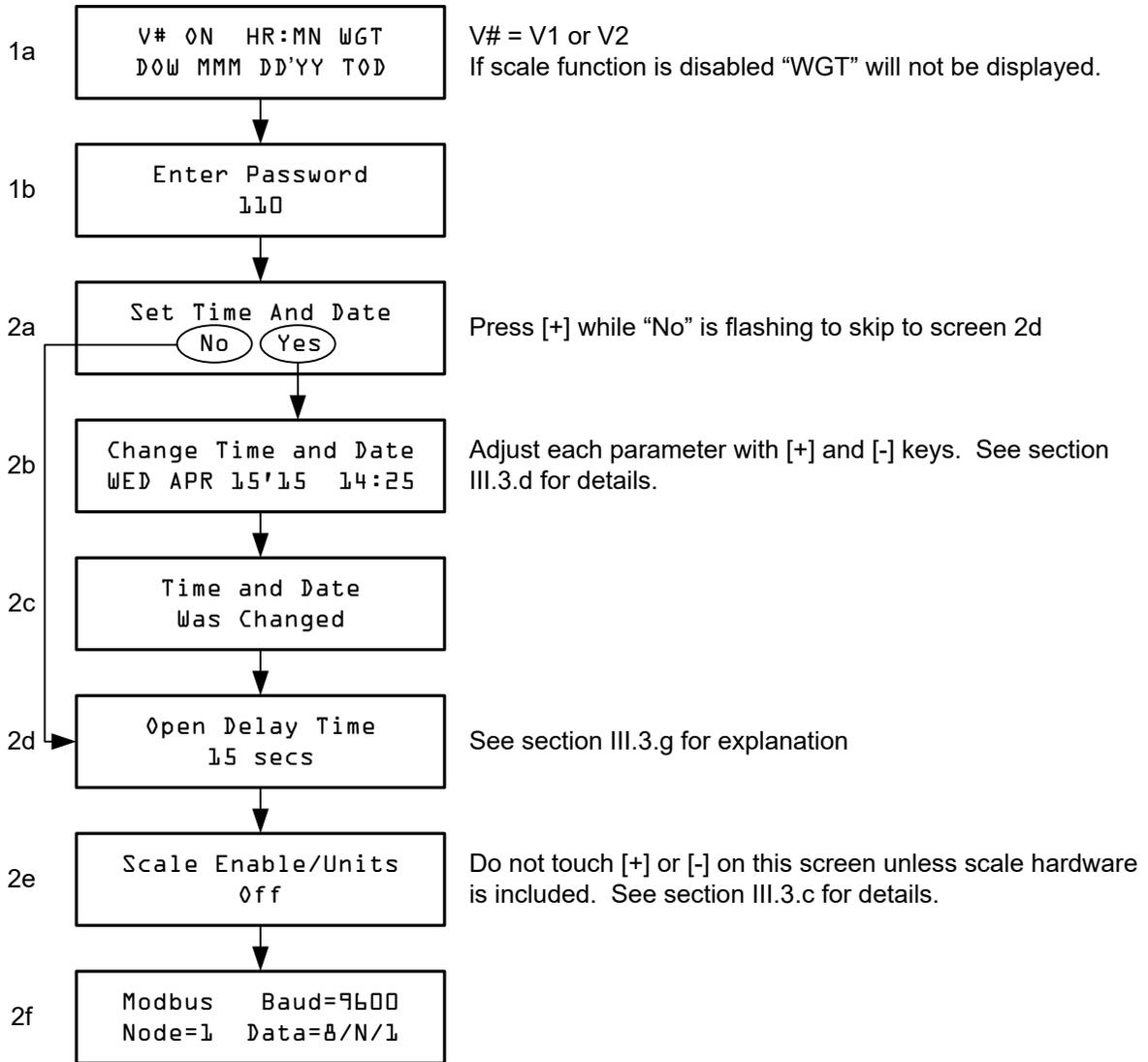
#### 2. Display and LED Description

##### LED's

The CS-110 controller includes the following LED's on the front panel.

WORK 1	=	Side #1 working indication LED (green)
EMPTY 1	=	Side #1 empty indication LED (red)
WORK 2	=	Side #2 working indication LED (green)
EMPTY 2	=	Side #2 empty indication LED (red)
RED	=	Low pressure condition
GREEN	=	Modbus communication

**Figure 3—Screen Flow Chart**



## DISPLAY

The CS-110 controller has the following display layout.

**Figure 4—Display Layout**

V#	ON	HR:MN	WGT
DOW	MMM	DD'YY	HH:MM

V1	ON	2:35	1755kg
TUE	APR	21'15	15:45

In Figure 4 above the variables displayed are as follows:

- V# = Either Valve No.1 (V1) or Valve No.2 (V2) is in the working state (“ON” or “OFF”).
- HR = Number of hours that this valve has been in the working state.
- MN = Number of minutes that this valve has been in the working state.
- WGT = Weight indication from external weighing scale.
- DOW = Day of the week (Mon, Tue, Wed, Thu, Fri, Sat, Sun)
- MMM = Month
- DD = Day
- YY = Year
- HH = Current hour—24 hour clock
- MM = Current minute

In the example given in Figure 4 above, the condition is as follows:

Valve No.1 (V1) is in the working state and has been in the working state for a total time of 2 hours and 35 minutes. The day of the week is Tuesday, the time of day is 15:45 and the date is April 21, 2015. The remaining weight on the scale for Valve No.1 (V1) is 1755 KG.

**Working Time**—The CS-110 controller will record and display the working time for each valve since the last time a pressure switch alarm signal was received from that side (i.e. since the last time that side had an empty alarm signal). Therefore, if Valve No.1 (V1) is operating for 10 hours and then the system is manually switched to feed from Valve No.2 (V2) without any alarm signal from the pressure Switch No.1 (S1), but later is switched back to Valve No.1 (V1), the controller will indicate this working time starting again at 10 hours.

### 3. Basic Operation

#### a. Initial Power Up

When power is turned on, the CS-110 will automatically go to the operating mode with Valve No.1 (V1) open and in the working state. The WORK1 LED should be illuminated.

#### b. Time / Date Adjustments (Figures 3, Screen 2b)

The display should indicate the correct date, day of the week and time of day. If not, then these parameters can all be adjusted. Press the  $\downarrow$  key one time to enter the configuration mode (via password: 110). Then press the  $\downarrow$  key so that 'Yes' is flashing on screen 2a. Then press the  $\oplus$  key to enter screen 2b. Adjust the time and date values on this screen.

#### c. Scale Setup (Figure 3, screen 2e)

*NOTE: If the optional input for weighing scales was not included, do not touch the  $\oplus$  key while on this screen. Should the  $\oplus$  key be accidentally pressed an alarm will sound and the CS-110 controller will need to be turned off. The alarm will clear once power is restored.* If the CS-110 includes the hardware to support scales inputs, then navigate to screen 2e and select the units desired for display (e.g. kg or Pd—for pounds).

#### d. Manual Changeover

In order to change from Valve No.1 (V1) to Valve No.2 (V2) in the working state, press the  $\oplus$  key one time. The WORK 1 LED will go dark and the WORK 2 LED will illuminate when the controller closes Valve No.1 (V1) after the delay time expires and opens Valve No.2 (V2).

#### e. Automatic Changeover

Under normal operation, one side should be in the working condition until the chlorine containers are nearly empty. When the chlorine containers are nearly empty the pressure will suddenly fall. The pressure switches should be set to alarm when the pressure falls below a user selected level (typically 1 to 2 kg/cm<sup>2</sup>). When the operating side receives the pressure switch signal, the alarm will sound, the EMPTY LED will illuminate and the controller will close that valve and open the standby valve. The scenario just described above is an automatic changeover. After a changeover has occurred, plant personnel must press the  $\ominus$  key one time to silence the audible alarm. The empty container(s) must also be replaced with new ones and connected to the manifold system again. After the containers have been changed and the supply manifold pipe pressure restored the  $\ominus$  key must be pressed again to clear the EMPTY alarm condition.

#### f. Stop Condition

If it is desired to close both sides of the system simultaneously then this feature should be used. During normal operation (i.e. if not in the time adjustment mode) to close both valves press the  $\oplus$  key one time. Both valves will close. In order to re-enter normal operation mode with Valve No.1 (V1) in the working condition press the  $\uparrow$  key one time. However, if there is an empty alarm condition present you will not be able to enter the normal working condition.

#### g. Valve Open Delay Time (Figure 3, screen 2d)

There is a user adjustable delay time (typically set to 10-15 seconds) for the time from when the working valve starts to close until the standby valve starts to open. This is done to allow the working valve time to fully close before the standby valve starts to open. Enter the password and navigate to screen 2d to adjust the delay time.

#### **4. Modbus Communication**

Modbus RS-485 communication. The CS-110 is equipped for remote display and communication using the Modbus RS-485 standard. To do this you must define the node, baud rate and parity of the system. For more information on how to setup Modbus refer to the Modbus Installation and Instruction manual. The Modbus Installation manual can be downloaded from the Hydro Instruments website ([www.hydroinstruments.com](http://www.hydroinstruments.com)). Printed copies are available upon request.

## **IV. MAINTENANCE**

When the system is working normally do not open the enclosure cover, do not touch the power supply or the circuit board. If the equipment system is not working properly because of the influence of the outside factors, you can turn off the power supply to reset the system and clear the problem. This will not influence the recorded information.