700 Series

Multi-Point Sampler

Operators Manual

California Analytical Instruments
www.gasanalyzers.com

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Safety Information

Safety Alert
Caution or Warning

Temperature Hazard
Caution or Warning

Electrical Shock Hazard
Caution or Warning

Laser Warning
Caution or Warning

NOTE: Caution and Warning symbols appear on the instrument and in this manual to draw your attention to important operational and safety information.

A "**NOTE**" is a short message that alerts you to an important operational detail.

A "**CAUTION**" safety alert appears with information that is important for protecting your equipment and its performance.

A "**WARNING**" safety alert appears with information that is important for protecting you, other people and equipment from damage. **Pay especially close attention to all warnings.**

The symbol (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.

The symbol (wavy vertical lines with an underscore in a triangle) precedes an elevated temperature hazard CAUTION or WARNING statement.

The symbol (a lightning bolt in a triangle) precedes an electrical shock hazard CAUTION or WARNING statement.

The symbol (laser) precedes a laser-light eye hazard CAUTION or WARNING statement.

Some or all of the above symbols may appear in this manual or on the equipment. This manual should be consulted whenever one of these symbols is encountered on the equipment.

ALWAYS REMOVE POWER BEFORE CONNECTING OR DISCONNECTING SIGNAL CABLES OR WHEN SERVICING THE EQUIPMENT.

700 Multi-Point Sampler Overview

Before using the analyzer, please familiarize yourself with its operation by reading this manual. If you have any questions, please do not hesitate to call California Analytical Instruments for assistance. We want you to be among our thousands of satisfied customers.

Unpacking Instructions

Open the shipping container and carefully remove the analyzer from the packing materials. Inspect the instrument for any sign of damage. Remove the top-cover retaining screws. Visually check for loose parts or connectors that are not properly seated. If all internal components look normal, re-install the cover.

Reporting Damage

Should there be any apparent damage either to the inside or outside of the instrument due to shipping or handling, immediately notify the shipper. The shipping container or packing materials should be retained for inspection by the shipper.

Contact Information

California Analytical Instruments, Inc.
1312 West Grove Avenue
Orange, CA 92865
Phone: 714-974-5560
Fax: 714-921-2531
Website: www.gasanalyzers.com

Proper Operation

Personnel should be trained in the proper operation of this equipment before attempting to operate it.

Possible Explosion Hazard

Do not apply power or attempt to energize the multi-point sampler until you determine the analyzer environment to be non-hazardous. Use this unit only in a **NON-HAZARDOUS** environment – it has not been designed for use with a hazardous sample.

Tampering or use of substitute components may cause a safety hazard. Use only factory-authorized replacement parts.

Electrical Shock Hazard

Disconnect power before removing the cover. Servicing requires access to live electrical components that can cause death or serious injury. Refer servicing to qualified service personnel. For safety and proper performance, connect this instrument to a properly grounded three-wire receptacle.

Warning

Using this equipment in a manner not approved by California Analytical Instruments is not recommended and may cause harm to the equipment or operating personnel

700 Multi-Point Sampler Product Information

The CAI 700 Multi-Point Sample Sequencer is designed to minimize the cost of operation and increase flexibility and options for monitoring multiple gas streams.

The CAI 700 Multi-Point Sampler's compact, modular design enables simultaneous analysis of up to 16 sample points. It allows sequential drawing of gases to the analyzer and the ability to read the active sample and sample countdown time. The unit is housed in a 19" rack-mount enclosure.

A single-board microcontroller with a Microchip CPU and a 7.0" LCD TFT color touch screen allow the user to easily program and manage event logic, solenoid valve timing and graphics. Modbus TCP/IP Ethernet connectivity lets you interface directly with a Network server or laptop computer.

Features

- Available from 2 to 16 sample points through solenoid valve switching
- 7" TFT LCD touch screen
- LCD displays active sample point with time-remaining countdown
- Selectable sample time and sample stream identification
- Manual override during sample sequencing
- Local or remote control
- Alarm displays
- Sample is continuously drawn into the sequencer through bypass sample pump, which minimizes response time and keeps non-active sample fresh. When one sample point goes to analyzer, the other samples are vented out.
- Micro-controlled valve driver PCB

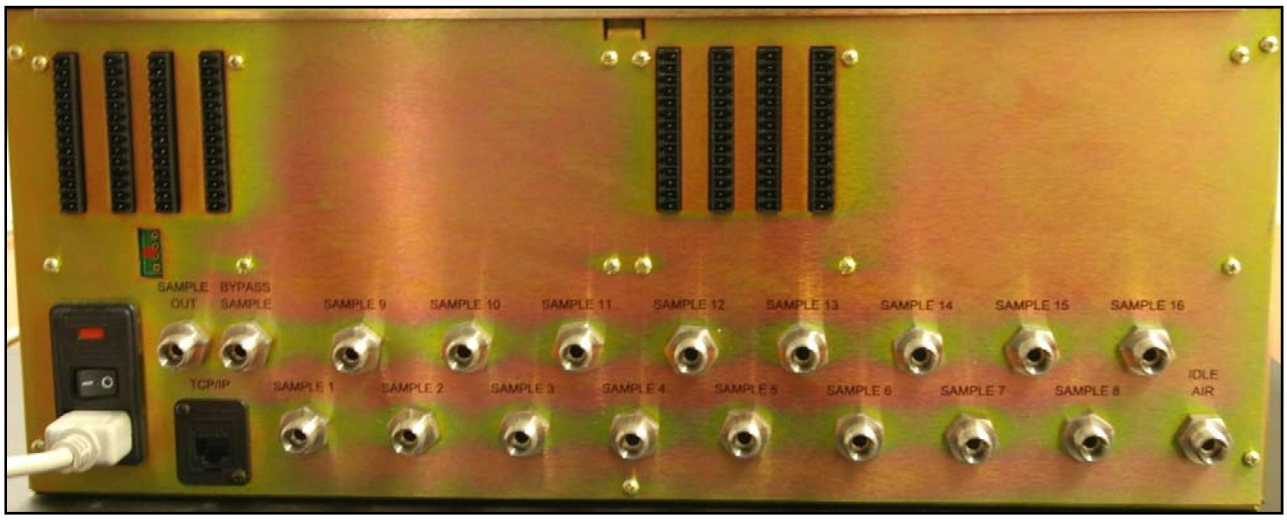
Specifications

Ranges:	2 - 16 sample points
Wetted Parts:	PTFE and 316SS, Viton
Sample Valves:	24 VDC, 7 Watts, SS body, Viton seals and seats
Sample Bypass Pump:	10.5 L/min, SS head
Ambient Temp Range:	5 - 40°C
Dimensions:	17" W x 22"D x 5.25"H
Cooling:	Fan
Weight:	25 lbs.
Power:	115 VAC, 3 Amps, 60 Hz
Communication:	Modbus, TCP/IP Ethernet, Digital I/O
Controller:	32-bit Microchip CPU with 7” LCD display

Operation of the CAI 700 Multi-Point Sampler

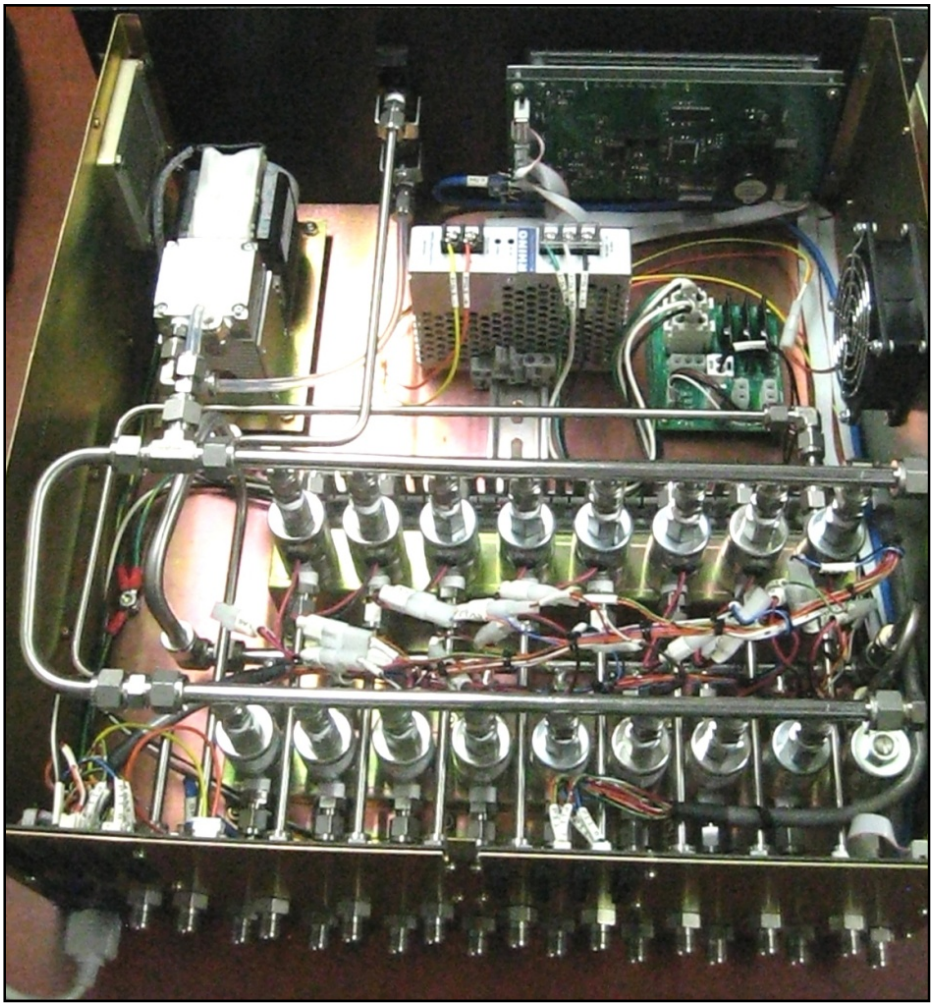
Hardware

CAI's 700 Multi-Point Sampler is a 19" rack-mount unit configured for sequencing of up to 16 different sample points.



Ethernet connection, Digital I/Os and sample ports on the back of the 700 Multi-point Sampler.

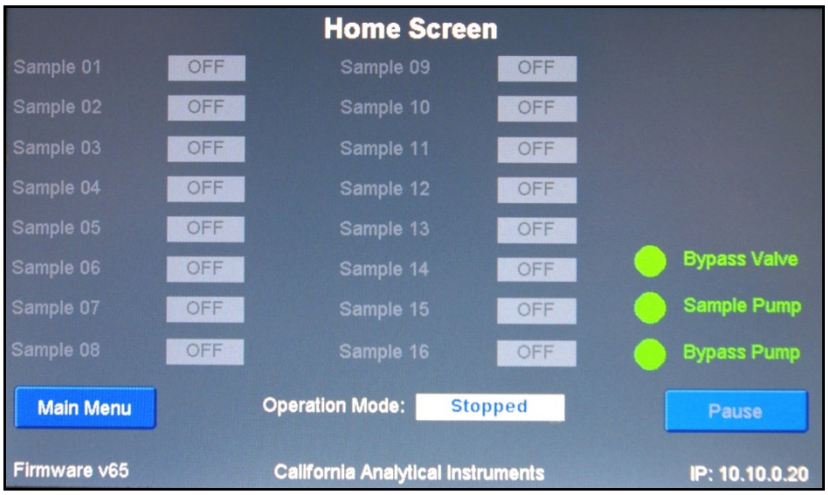
The 700 Multi-Point Sampler can be controlled via the touch-screen front panel. It can also be controlled remotely by Modbus TCP/IP via Ethernet connection or digital inputs via 14-pin connectors on the back of the unit.



The inside of the unit includes a bank of solenoid valves and control board. There is also a bypass pump to pull from all inactive samples continuously. An external pump is required to pull the active sample point for analysis into the analyzer.

A relay board provides AC power to the bypass pump. The 24 VDC power supply delivers power to the microcontroller, the cooling fan and the solenoid valve driver PCBs. All internal tubing is ¼” 316 Stainless Steel or ¼” PTFE.

Home Screen



When the 700 Multi-Point Sampler is first turned on, the CAI logo flashes on the screen. As soon as the unit boots up, the Home screen (above) appears. This screen shows the current statuses of all sample points and countdowns. At the bottom of the screen (from left to right), the firmware version, the California Analytical Instruments designation in text, and the IP address are all displayed.

You can easily return to the Home screen from any other screen by pressing the Home Screen button.

IMPORTANT:

The following functions are accessible from the Home Screen:

- **Bypass Valve** – The bypass valve comes on when no sampling solenoid valves are active. This allows the downstream sample pump to pull external air through the sample system.

- **Sample Pump** – An external sample pump can be controlled via the multi-point sampler's relay PCB.

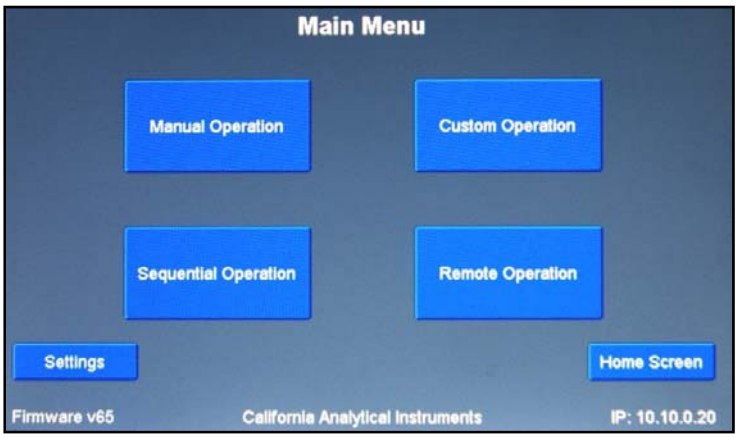
- **Bypass Pump** – The Bypass pump draws sample continuously from all sample points to minimize response times when switching to different sample streams. The Bypass pump is installed inside the multi-point sampler.

- **Operation Mode Button** – This button will display any of the built-in operation modes including Manual, Sequential, Custom, Remote or Stopped.

- **Pause/Resume Button** – During any sampling or sequence, when Pause is highlighted, this button can be pressed to pause any operation. Once the button is pressed and the operation is paused, the button will change to "Resume." Pressing the button a second time will resume operation and countdown.

Main Menu

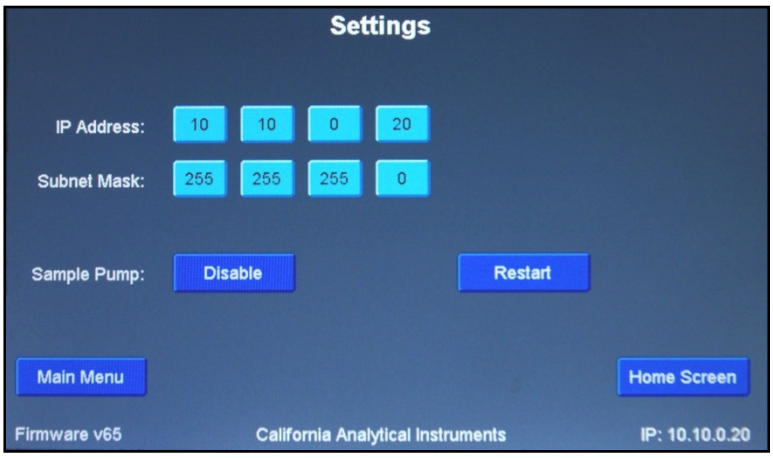
From the Home Screen, press the Main Menu button.



The Main Menu screen provides access to the multi-point sampler's different menus.

Settings Screen

To access the Settings Screen, press the Settings button on the Main Menu screen.

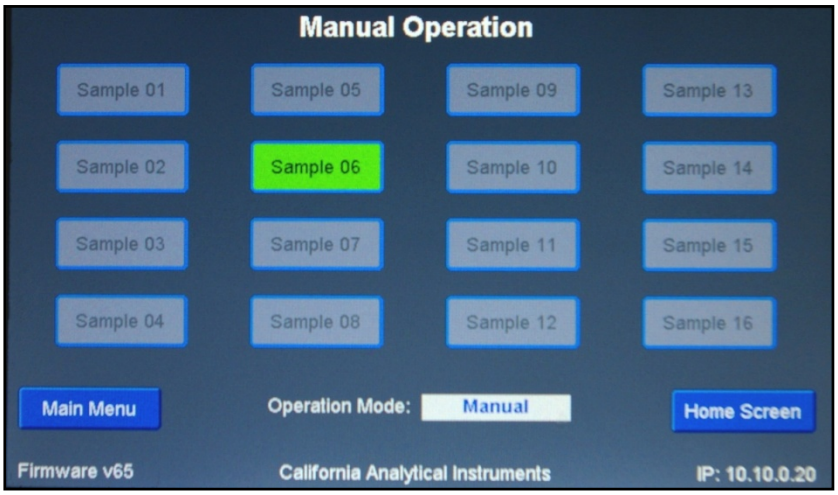


With the Settings screen, you can change the IP address. That allows for Modbus configurability. The current address is the default address for this unit. If this address is changed, the system will have to be rebooted to keep this new IP address.

Manual Operation

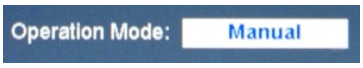
From the Main Menu, press the Manual Operation button

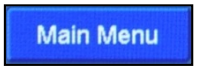
to bring up the Manual Operation screen.



Manual Operation is fairly simple. To select a sample, press the desired button. The button will turn a green color. In the example above, Sample 06 has been selected. To turn a sample off, press the button a second time. You will hear the solenoid valve click and the button will return to a bluish color.

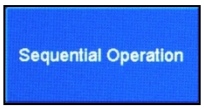
NOTE: in Manual Operation mode, only one sample can be selected or turned off at a time.

You can return to the Home screen at any time, and you will notice that the active sample will be on and the Operation Mode will display Manual. 

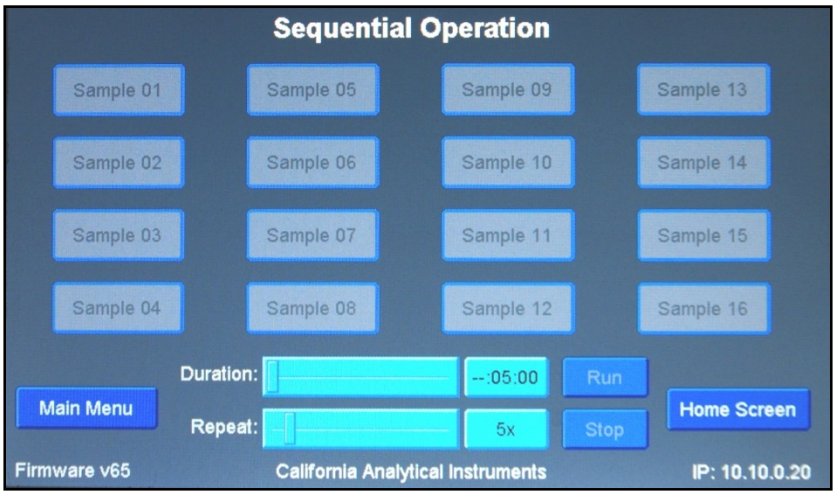
. The Main Menu button 

will return you to the Main Menu where you can choose other modes of operation.

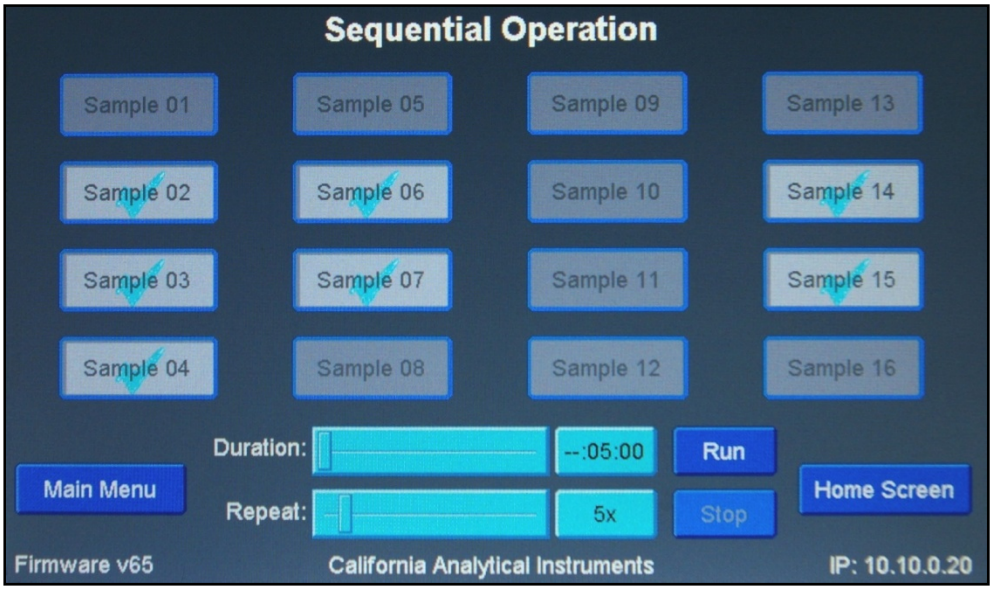
Sequential Operation

From the Main Menu, press the Sequential Operation button 

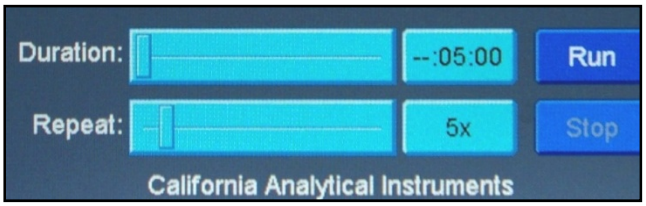
to access the Sequential Operations screen. This mode allows the user to select various samples. In Sequential Operation mode, all samples will be run in sequence with the same duration time.



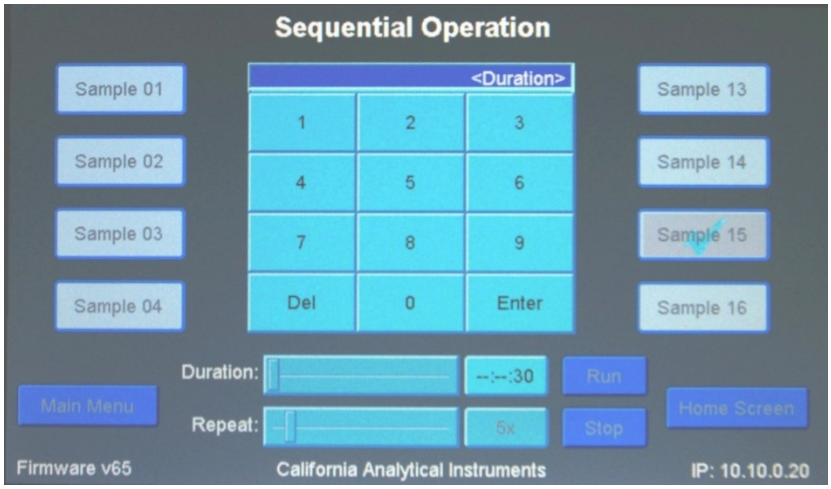
Use the touch screen to select the inputs you intend to monitor. In the example below, the input valves being monitored are checked.

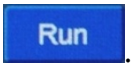


From the Sequential Operation screen, you can set the durations of the samples by using the slider:



Or, when more precise operation is required, you can access the Sequential Operation Duration keypad by pressing the button between the Duration slider and the Run button (--:05:00 in the example above).



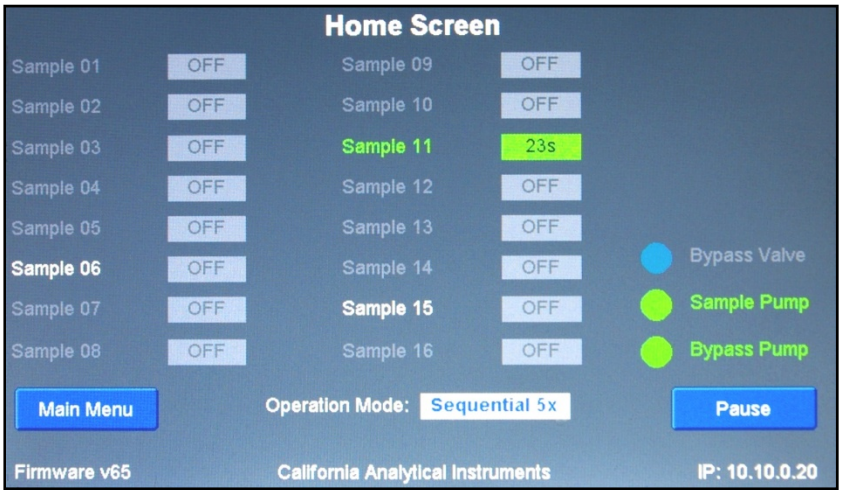
Once you have selected your duration, click the Run button 

. The sequencer performs a countdown of each sample being run. If there is a higher number you would be able to see it, and it will repeat this sample sequence as many times as were selected with the Repeat button (5x in the example above). Enter 0 for continuous operation.

Sample Countdown Points

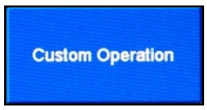
Once the sequencer is running the samples you have chosen, press the Home Screen button

to view your samples counting down. In the example below, Sample 11 has 23 seconds left before switching to the next valve:

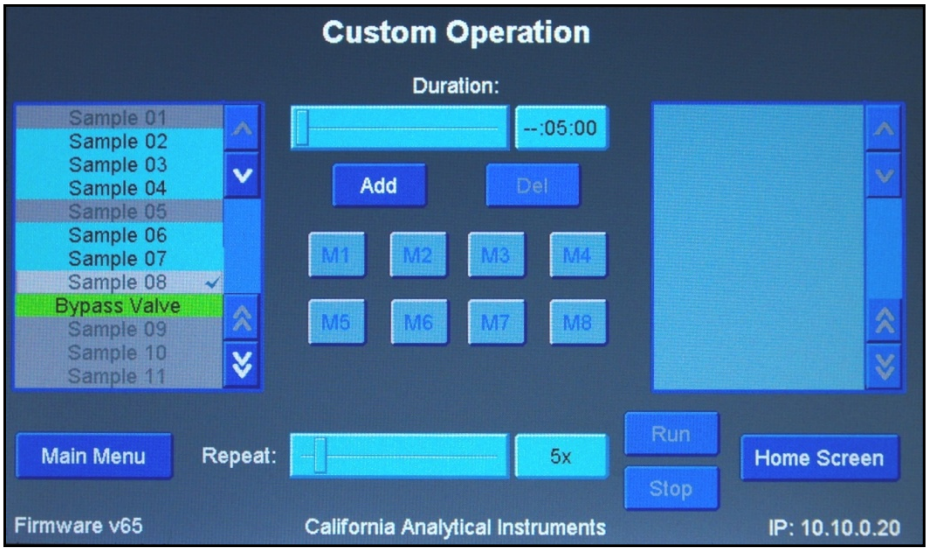


Custom Operation

To perform a Custom Operation, select the Custom Operation button on the Main Menu screen.

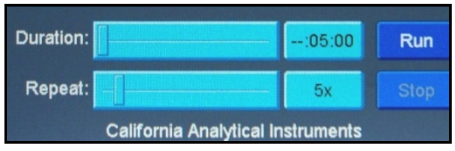


With Custom Operation, you can select and activate different solenoid valves, each with its own custom setting for the duration of time you allow sample to flow through each valve. You can save up to eight sequences and store them in memory for recall as required.



1. To add a sample duration to memory, highlight the sample whose duration you wish to change in the list on the left side of the screen.

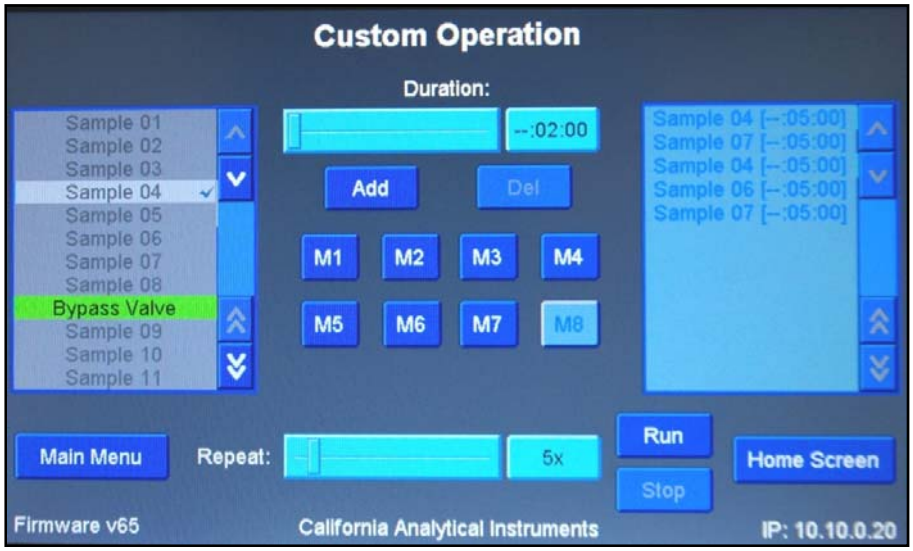
2. Access the Duration keypad by pressing the button between the Duration slider and the Run button (--:05:00 in the example).



3. Enter the desired duration on the keypad.

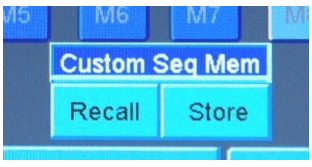
   Press Enter to save your selection.

4. Press the Add button (see example screen below) to add this sample duration to your list on the right side of the screen.



5. Press the desired Memory button to store your sequence.

   Up to eight sequences can be stored in memory and recalled as required.

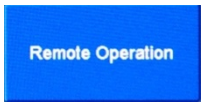
6. To store or recall sequences, press the desired memory button. 

The small Custom Sequence Memory window will appear. Press Store to store the sequence for the sample you have selected. To recall and activate a sequence, first press the desired memory button, then press Recall. Repeat this routine as required.

7. If necessary, delete entries so sample durations can be reset. Press the sample number(s) you wish to delete from the list on the right side of the screen (see the Custom Operation example screen above). Then press the Del button to delete them.

NOTE: The Bypass valve is on when none of the sample solenoid valves are active. This allows the working sample pump to pull air if it’s not sampling any gas.

Remote Operation

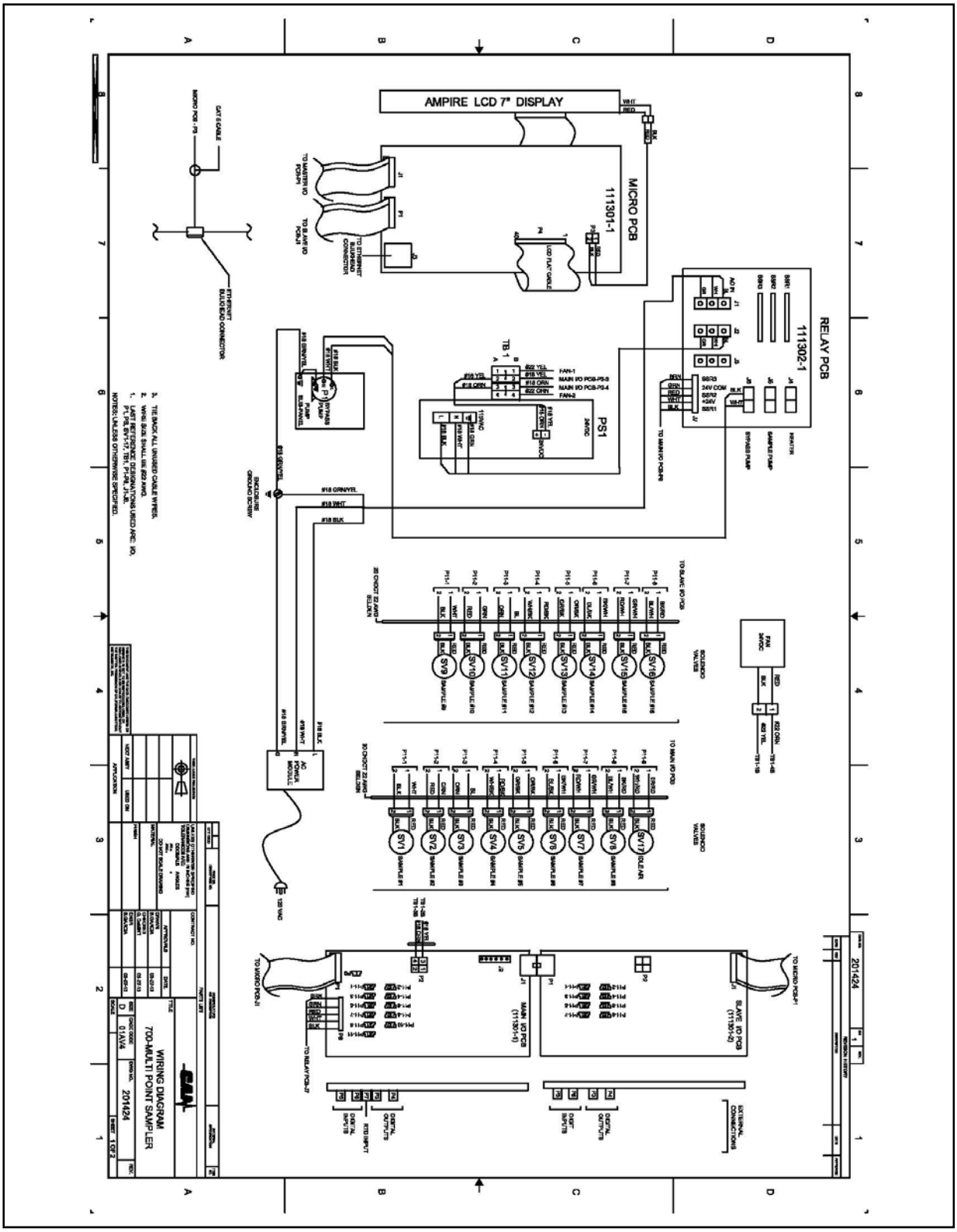
From the Main Menu, press the Remote Operation button 

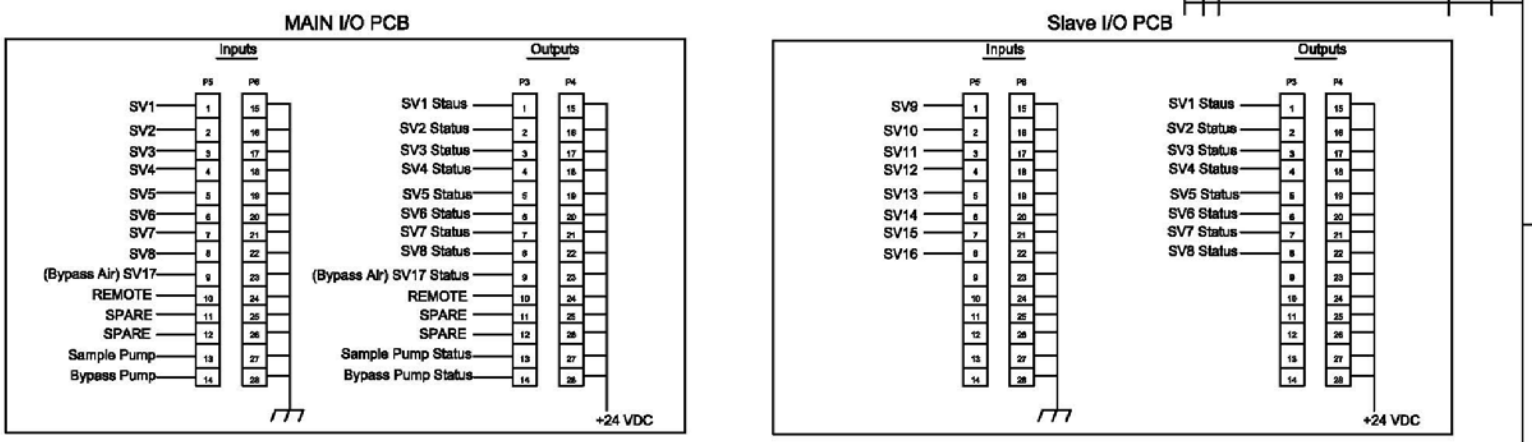
to operate the sequencer from a remote location.

Remote operation cancels everything that has been running (all current settings), and the multi-point sampler is now completely controlled via the remote inputs. You can either control operation with digital input (if you have a PLC you basically send the signal there from the PLC) or you can use Modbus TCP.

NOTE: Remote Operation will allow the user to turn on or off individual solenoid valves and to read their statuses. It will not allow configuration of sequences or the ability to set up times. Digital outputs are always active to monitor solenoid valve status. When the 700 Multi-Point Sampler is not in Remote mode, all inputs are disabled.

Wiring and Flow Diagrams





I/O BOARD #1 MODBUS DETAIL

DEVICE ID	MODBUS TYPE	MODBUS REGISTER	APPLICATION
1	COIL	1	SV1
1	COIL	2	SV2
1	COIL	3	SV3
1	COIL	4	SV4
1	COIL	5	SV5
1	COIL	6	SV6
1	COIL	7	SV7
1	COIL	8	SV8
1	COIL	9	SV17 (BYPASS AIR)
1	COIL	10	REMOTE MODE
1	COIL	11	SPARE
1	COIL	12	SPARE
1	COIL	13	SAMPLE PUMP
1	COIL	14	BYPASS PUMP
1	INPUT	1	SV1 STATUS
1	INPUT	2	SV2 STATUS
1	INPUT	3	SV3 STATUS
1	INPUT	4	SV4 STATUS
1	INPUT	5	SV5 STATUS
1	INPUT	6	SV6 STATUS
1	INPUT	7	SV7 STATUS
1	INPUT	8	SV8
1	INPUT	9	SV17 (BYPASS AIR)
1	INPUT	10	REMOTE MODE
1	INPUT	11	SPARE
1	INPUT	12	SPARE
1	INPUT	13	SAMPLE PUMP
1	INPUT	14	BYPASS PUMP

I/O BOARD #2 MODBUS DETAIL

DEVICE ID	MODBUS TYPE	MODBUS REGISTER	APPLICATION
2	COIL	1	SV9
2	COIL	2	SV10
2	COIL	3	SV11
2	COIL	4	SV12
2	COIL	5	SV13
2	COIL	6	SV14
2	COIL	7	SV15
2	COIL	8	SV16
2	INPUT	1	SV9 STATUS
2	INPUT	2	SV10 STATUS
2	INPUT	3	SV11 STATUS
2	INPUT	4	SV12 STATUS
2	INPUT	5	SV13 STATUS
2	INPUT	6	SV14 STATUS
2	INPUT	7	SV15 STATUS
2	INPUT	8	SV16 STATUS

NOTES:

Digital Inputs on PCB's are dry contact inputs

Digital outputs on PCB's are 24 VDC outputs

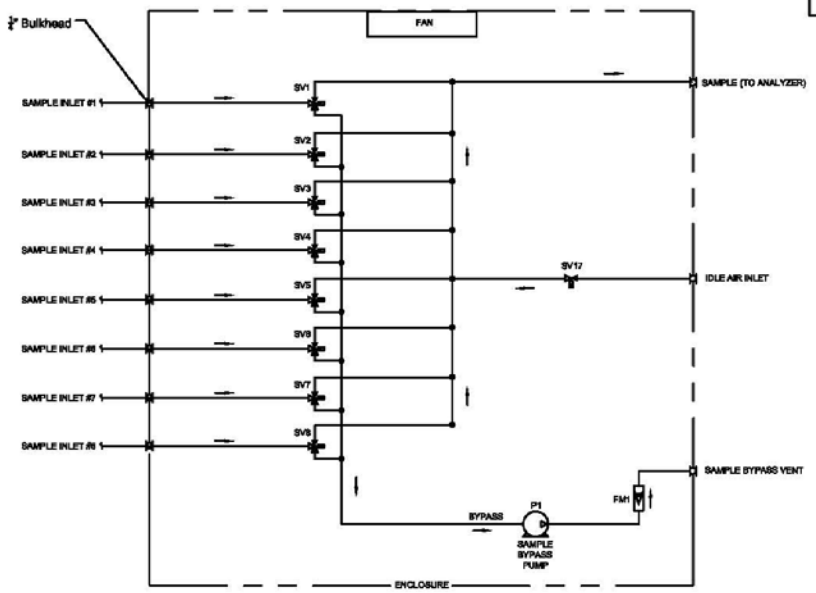
WIRING DIAGRAM
700-MULTI POINT SAMPLER

D 01AV4 201424

SHEET 2 OF 2

DWG NO. 201484 SH 1 REV.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED



2. THREE-WAY SOLENOID VALVE LEGEND: 2 (C), (NC) 1, NO.

1. TWO-WAY SOLENOID VALVE LEGEND: 2 IN, 1 OUT

NOTES:

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO.

PARTS LIST

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
TOLERANCES ARE:
DECIMALS ANGLES
.XX± ±
.XXX±

DO NOT SCALE DRAWING

MATERIAL

FINISH

NEXT ASSY | USED ON

APPLICATION

CONTRACT NO.

APPROVALS	DATE
DRAWN B. GARCIA	07-23-14
CHECKED G. DEMINT	07-23-14
ENGR B. GARCIA	07-23-14

CAI

TITLE
FLOW DIAGRAM
700 MPS 8-CHANNEL

SIZE	CAGE CODE	DWG NO.	REV.
B	01AV4	201484	

SCALE | SHEET 1

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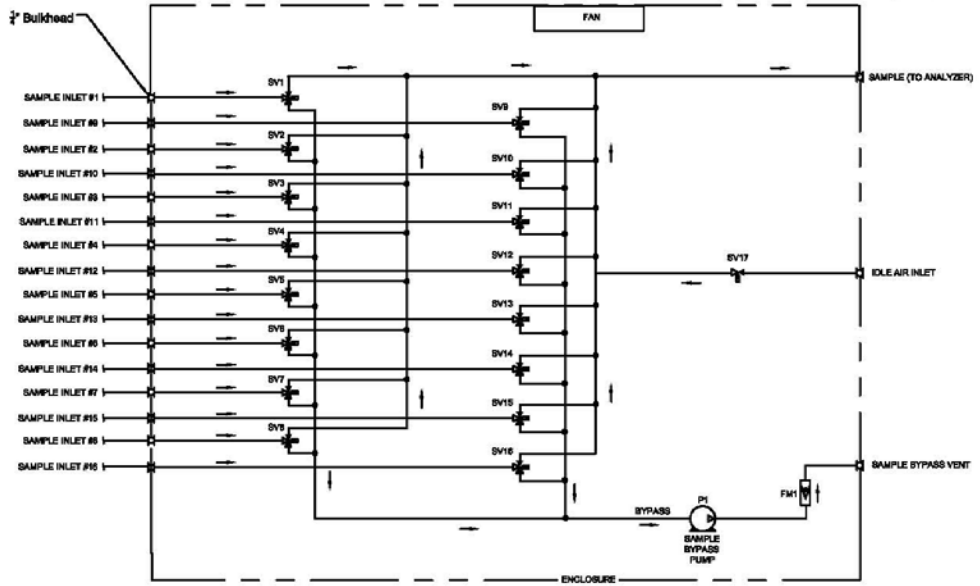
DWG NO. 201486 SH 1 REV.

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED



2. THREE-WAY SOLENOID VALVE LEGEND: 2 (C), (NC) 1, NO.

1. TWO-WAY SOLENOID VALVE LEGEND: 2 IN, 1 OUT

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THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [mm]
TOLERANCES ARE:
DECIMALS ANGLES
.XX± ±
.XXX±
DO NOT SCALE DRAWING

MATERIAL

FINISH

NEXT ASSY | USED ON

APPLICATION

CONTRACT NO.

APPROVALS	DATE
DRAWN B. GARCIA	07-23-14
CHECKED G. DEMINT	07-23-14
ENGR B. GARCIA	07-23-14

CAI

TITLE
FLOW DIAGRAM
700 MPS 16-CHANNEL

SIZE	CAGE CODE	DWG NO.	REV.
B	01AV4	201486	

SCALE | SHEET 1

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Warranty Statement

Subject to the exceptions and upon the conditions stated below, California Analytical Instruments (CAI) warrants that the products sold under this sales order shall be free from defects in workmanship and materials for one year after delivery of the product to the original Buyer by CAI and if any such product should prove to be defective within such one year period, CAI agrees, at its option, either (i) to correct by repair or, at CAI's election, by replacement with equivalent product any such defective product, provided that investigation and factory inspection discloses that such defect developed under normal and proper uses, or (ii) to refund the purchase price. The exceptions and conditions mentioned above are as follows:

a) components or accessories manufactured by CAI which by their nature are not intended to and will not function for one year are warranted only to give reasonable service for a reasonable time; which constitutes reasonable time and reasonable services shall be determined solely by CAI. A complete list of such components and accessories is maintained at the factory;

b) CAI makes no warranty with respect to components or accessories not manufactured by it; in the event of defect in any such component or accessory CAI will give reasonable assistance to Buyer in obtaining from the respective manufacturer whatever adjustment is authorized by the manufacturer's warranty;

c) any product claimed to be defective must be returned to the factory transportation charges prepaid and CAI will return the repaired or replaced product freight collect;

d) if the product claimed to be defective requires on-site repair, such warranty labor will be provided at no charge; however, transportation and living expenses will be charged to Buyer;

e) if the product is a consumable or the like, it is warranted only to conform to the quantity and content and for the period (but not in excess of one year) stated on the label at the time of delivery or 90 days;

f) CAI may from time to time provide a special printed warranty with respect to a certain product, and where applicable, such warranty shall be deemed incorporated herein by reference;

g) CAI shall be released from all obligations under all warranties, either expressed or implied, if any product covered hereby is repaired or modified by persons other than its own authorized service personnel unless such repair by others is made with the written consent of CAI.

IT IS EXPRESSLY AGREED THAT THE ABOVE WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND OF THE WARRANTY OF MERCHANTABILITY AND THAT CAI SHALL HAVE NO LIABILITY FOR SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR FROM ANY CAUSE WHATSOEVER ARISING OUT OF THE MANUFACTURE USE, SALE, HANDLING, REPAIR, MAINTENANCE OR REPLACEMENT OF ANY OF THE PRODUCTS SOLD UNDER THIS SALES ORDER. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE.

Representations and warranties made by any person, including dealers and representatives of CAI, which are inconsistent, or in conflict with the terms of this warranty, shall not be binding upon CAI unless reduced to writing and approved by an expressly authorized officer of CAI.

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