OPERATING MANUAL
MODEL 4207D
DIGITAL COMPRESSIVE STRENGTH TESTER

Revision M – November 2015
P/N: 89-0164

S/N: _____

AMETEK®
CHANDLER ENGINEERING®

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General Information

Introduction

The Model 4207D Digital Compressive Strength Tester is a hydraulic press system that may be used to apply known compressive loads to a sample at known rates. The maximum load is 50,000 Lbf. The Model 4207D Tester meets all the requirements for cement compressive testing as specified in API Specification 10.

Purpose and Use

The Model 4207D Compressive Strength Tester is designed to test the compressive strength of sample cement cubes in compliance with API Specification 10. The Model 4207D enables the operator to achieve steady, uniform loading of the sample in order to obtain an accurate measure of the compressive strength.

Description

The sample load schedule is programmable as a series of ramps and dwells using a controller. The system is equipped with a digital display that retains the maximum load that causes the failure of the sample under test.

Features and Benefits

- Programmable loading rates from 500 to 10,000 psi/min (2000 to 40,000 Lbf/min)
- Maximum load of 50,000 Lbf
- Polycarbonate safety shield with door safety interlock
- Multiple load rates/durations can be programmed as a single control operation
- Precise rate control electronic system and hydraulic pressure release valves providing outstanding control of the loading rate
- Interface to Model 5270 Data Acquisition and Control Software (used to acquire and plot the results)

Specifications

Power Requirements:	200-240 VAC, 50 Hz or 60 Hz
Maximum Load:	50,000 pounds-force (Lbf), 222 kN
Maximum Loading Rate:	40,000 Lbf/Minute (178 kN/min)
Maximum Load Dwell:	3 min @ 50,000 Lbf (222 kN) with initial oil temperature below 75^{o}F (24^{o}C)
Maximum Oil Temperature:	175^{o}F (60^{o}C)
Environmental:	40-120^{o}F (4-49^{o}C) 95% Relative Humidity (non-condensing)

Serial Interface:	Modbus-RTU Protocol	
Hydraulic Fluid:	SAE 10W30 Synthetic Oil	
Shipping Dimensions:	Load Frame 48” (122 cm) high x 24” (61 cm) wide x 28” (71 cm) deep	
	Control Cabinet 54” (138 cm) high x 28” (71 cm) wide x 30” (76 cm) deep	
Net Weight:	Load Frame	360 lbs (164 kg)
	Control Cabinet	570 lbs (260 kg)

Safety Requirements

Note: Before attempting to operate the instrument, the operator should read and understand this manual.

The Chandler Engineering Model 4207D Digital Compressive Strength Tester is designed for operator safety. Any instrument that is capable of high pressures should always be operated with **CAUTION**!!

To ensure safety:

- Locate the instrument in a low traffic area.
- Post signs where the instrument is being operated to warn non-operating personnel.
- Read and understand instructions before attempting instrument operation.
- Observe caution notes!
- Observe and follow the warning labels on the instrument.
- Never exceed the instrument maximum temperature ratings.
- Always disconnect main power to the instrument before attempting any repair.
- Appropriately rated fire extinguishers should be located within close proximity.
- Only trained personnel should operate the system.
- The system should never be operated while unattended.
- All personnel using the system should wear safety glasses.
- The system must be located in a safe environment.
- All safety interlocks must be operational and properly adjusted.
- The system must be properly maintained and any defective components serviced or replaced.

Safety Features

- ***Door interlock switch***: Prevents the operation of the system when the press door is open.
- ***Over temperature safety circuit***: Prevents the operation of the system if the oil temperature exceeds the specified limit.

- ***Automatic system shut-down***: The controller automatically terminates the active program when the sample fails.

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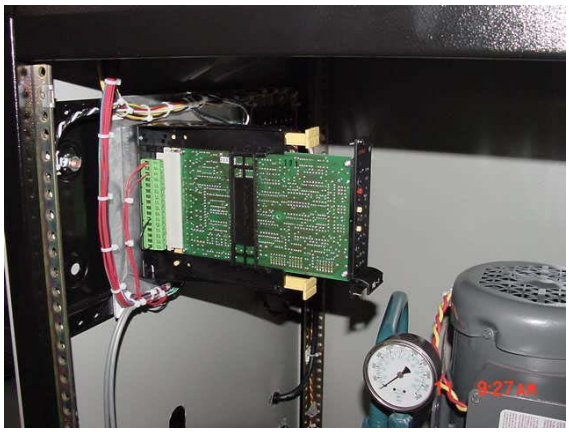
Section 1 – Installation

Unpacking the System

Carefully unpack the Model 4207D and all of its accessories. Visually inspect for any damage that may have occurred during shipping. After the instrument is removed from the shipping crate, the equipment and spare parts should be checked against the packing list to insure that all parts have been received and none are damaged.

Remove the front cover of the instrument to remove the circuit board and spare parts that are individually wrapped to prevent damage during shipment. Slide the circuit board into the backplane as illustrated below; then replace the front cover.



Note: File an insurance claim with your freight carrier if damage has occurred during shipping. Verify all parts shown on the enclosed packing list have been received. If items are missing, please notify Chandler Engineering immediately.

Utilities Required

Electrical: 200-240 VAC, 50 Hz or 60 Hz, depending on model.

Tools/Equipment Required

No special tools are required for the installation of the Model 4207D. Standard hand tools are sufficient.

Connecting Power

Connect the power cord to an approved grounded receptacle in accordance with local wiring codes. Model 4207D-60Hz is intended for use on, 200-240 VAC 60 Hz and Model 4207D-50Hz is intended for use on, 200-240 VAC 50 Hz.

The system power switch on the front panel also serves as a circuit breaker. If the breaker trips, correct the electrical problem then reset the breaker by cycling the switch.

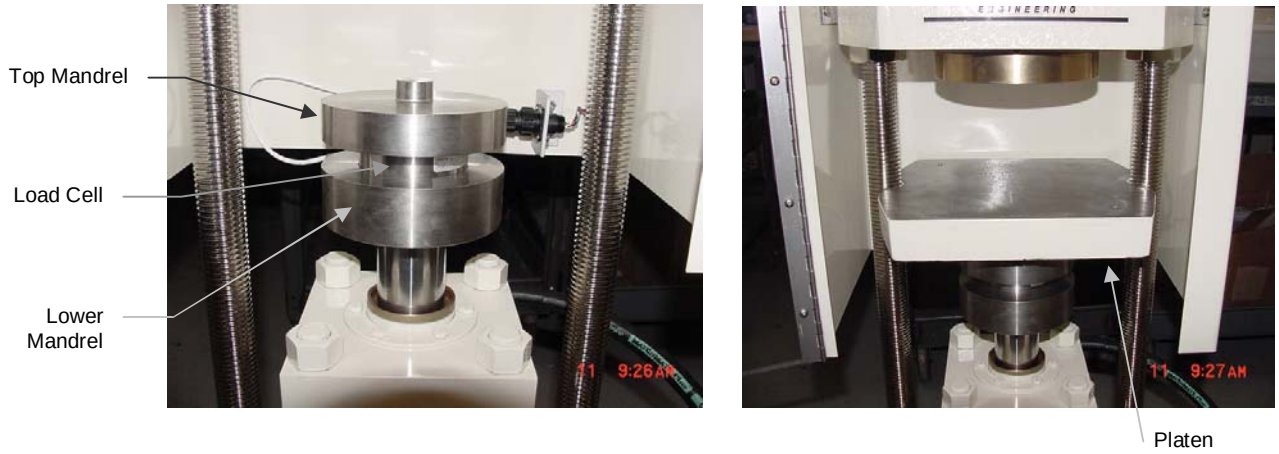
Connecting the Press to the Power Unit

There are three connections between the load frame and the control cabinet, 2 hydraulic lines and a 25-pin cable connection.

1. Connect the two hydraulic lines to the quick-connect fittings on the left side of the control cabinet. Make certain that the hydraulic connections are fully coupled. The hose from the bottom of the cylinder is connected to the bottom connection on the control cabinet.

2. Connect the cable between the two 25-pin connectors located on the load frame and the control cabinet. The cable connections are labeled with a RED circle.

3. Assemble the bottom platen and load cell in accordance with the illustration below:



Connecting to a Data Acquisition System

Serial Data Connection

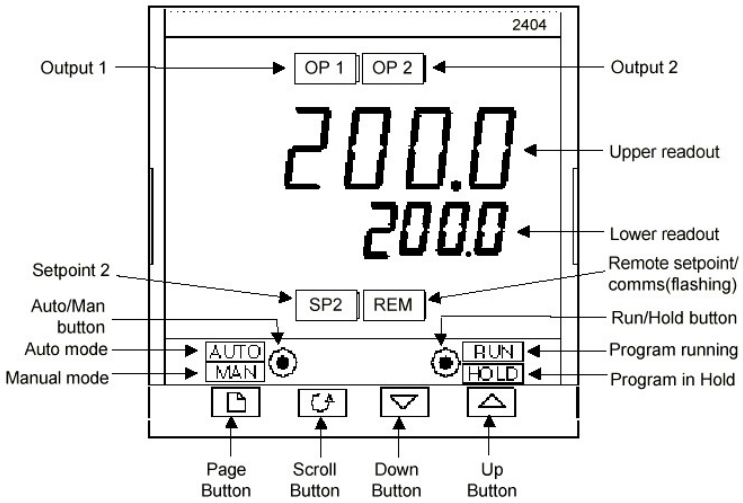
The control cabinet includes a 25-pin connector on the left of the enclosure that is used for communications with the optional Chandler Engineering Model 5270 Data Acquisition and Control Software. The cable connections are labeled with a BLUE circle. A cable is supplied with the unit.

Section 2 - Operating Instructions

Before operating the 4207D it is necessary to be familiar with the press controller and load indicator features and controls.

Programming the Controller

The Model 7052 controller used with the 4207D system features user defined segment programming (8 segments maximum). Using these segments, sample load ramp and dwell segments are defined.



Controller Feature	Description of Feature
Output 1 or 2:	Not active.
Upper Readout (Process Value)	Displays the current value of the sample load. This value must be multiplied by 10 to indicate pounds-force (Lbf).
Lower Readout or (Setpoint Value)	Indicates the current set point value. Indicates alarm condition in the event of an alarm.
Remote Communication	Indicates remote communication if the system is equipped with this option.
Auto/Manual Button	Changes the mode of the controller from Automatic to Manual. When the controller is not being used, place the controller in Manual mode and verify that the lower readout displays ***Off*.**
Run/Hold Button	Used to Run, Hold, or Terminate a program. Press once to Run the program. Press again to Hold the program. Press for over 3 seconds to terminate the program.
Page Button	Used to page through the various menus in the controller.
Scroll Button:	Used to scroll through the parameter settings within a menu page.
Up/Down Buttons:	Used to change the value of a parameter. Press and hold the button for rapid changes to a value.
Setpoint 2	Not used

Configuring the controller to perform a sample load program involves defining a series of ramp and dwell segments.

Once the program exists, the program is executed by pressing the ***Run*** button. To suspend the program the ***Run/Hold*** button may be pressed briefly (*Hold* light illuminates) and restarted by pressing the ***Run/Hold*** button again.

To terminate the program, the ***Run/Hold*** button is pressed until the ***Run*** light is *Off*. Press the ***Auto/Man*** button to place the controller in manual mode.

Use the following procedure to define and run a program:

1. Turn the system ***On***.

2. Press the ***Page*** button until the ***Prog*** menu appears.

3. Press the ***Scroll*** button until the Segment number 1 is displayed (***SEG.n*** with the set point value reading 1 indicates segment number 1)

4. Press the ***Scroll*** button twice.

5. Enter the segment type (***tYPE***). Use the Up/Down buttons to enter a *ramp time* (***rmP.t***) type.

6. Press the ***Scroll*** button.

7. Enter the target setpoint (***tGt***). This is the desired load at the end of the ramp, expressed in units of Lbf/10.

8. Press the ***Scroll*** button.

9. Continue the process of defining remaining segments. The maximum number of segments is 8.

10. The final segment type has a type ***End.***

11. Press the ***Run/Hold*** button to start the program.

12. To stop the program, hold the **Run/Hold** button until the ***Run*** light turns ***Off***.

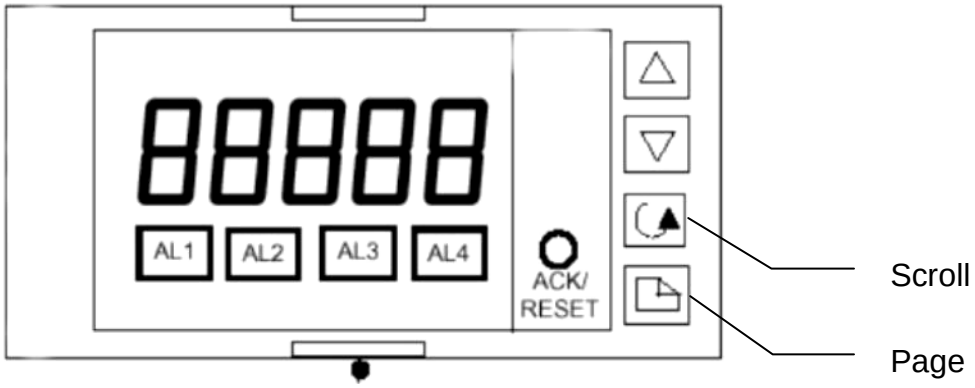
Sample Controller Program

The following table provides the API Specification 10 programs for the controller.

Note: The indicated value on the controller and display must be multiplied by 10 for the force in pounds-force (Lbf).

Segment Number	Segment Type	Value, Lbf/10	Time, min	Comment
1	Ramp Time	15	0.5	This is used to load the sample.
2	Dwell		0.5	
3	Ramp Time	4800	3.00 or 12.00	API Spec 10A Ramp rates of 16,000 Lbf/min or 4,000 Lbf/min.
4	End	Rset		Ends the program once the setpoint is reached.

Configuring the Display



The display indicates the sample load in units of Pounds-Force (Lbf) and stores the maximum value. The display may be configured for other units of force by rescaling the display and controller. Contact Chandler Engineering for instructions if the display must be rescaled.

Note that the value displayed by the controller must be multiplied by 10 to obtain Lbf. The display indicates in units of Lbf directly.

The display provides the peak value to the 5270 Data Acquisition software every 1 second using the serial communication port.

Note: The scaled peak value is available at Modbus register 133 (2:133f). To reset the peak value, 5270 must be configured to transmit a 0 to Modbus register 133 (2:133f) when a test is started. This is accomplished using the Start Sequence option in the instrument Test Profile definition. The device address and register (2:133f) must be configured in the Advanced option for the Lbf load signal.

Note: The display calibration is based on the calibration certificate provided with the load cell and the excitation voltage (+10Vdc). If the instrument must be recalibrated, an independent load cell must be loaded into the press and used to validate the output of the load cell in the instrument. Any changes to the

calibration values must be configured in the display and controller (CONFIG – IP menus).

The display is configured to display the current value. To display the peak value, press the UP or DOWN arrow, the peak value will display for 2 seconds then revert to the current value.

The load cell used in the instrument is rated for 0 – 50,000 Lbf. The load cell output is not exactly 0.000 mV due to the mass of the platen. The display is adjusted to display 0 Lbf using the Offset option. This value is set by the factory but may require periodic adjustments:

- Press Scroll one time until OFS.1 is displayed.
- Press UP or DOWN arrow to change the value. Adjust the value until the main display indicates 0 Lbf.
- Press Scroll two times to return to the main display.

Although the 5270 software resets the peak value in the display when a new test starts, the user may manually reset the stored peak using the following procedure:

- Press Scroll two times until RES.L is displayed.
- Press UP or DOWN arrow two times to select YES. The display will flash.
- Press Scroll one time to return to the main display.

Operating Procedure

1. Turn the system ***On***.

2. If required, push the cylinder control switch, located to the right of the power switch, to the ***Down*** position to lower the platen. This will lower the platen to provide adequate clearance for the sample.

3. Turn the cylinder control switch to the ***Off*** position.

4. The platen has an engraved square that will approximately match the size of the sample block. Place the sample within the center of this square. It is critical that the sample be centered on the platen. Leave approximately ¼" of clearance between the sample and the top platen.

5. Close the door on the press assembly.

6. Reset the peak value stored in the display by pressing the Scroll button until RES.L is displayed. Press Up or Down arrow two times to select YES. The display will flash. Press the Scroll button to return to the main display.

Note: The 5270 DACS software will automatically reset the peak value stored by the display when a data acquisition test is started.

7. If using a data acquisition system, start the program.

8. Confirm the controller is idle and in manual (MAN) mode by performing the steps below.
   a. Press and hold the RUN/HOLD button for three seconds or longer. This will reset and idle the controller. The RUN and HOLD indicators will extinguish.
   b. Press the AUTO/MAN button to switch from automatic (AUTO) mode to manual (MAN) mode. The MAN indicator will illuminate.

9. Select the proper ramp time in segment three (Seg.n 3) of the controller program to match the rate desired. Additionally, select the target pounds-force value in segment three (Seg.n 3), if the desired value is different than 48000 Lbf. DO NOT change any other segment values.

   To change the Seg.n 3 values;

   a. Press the ***Page*** button until the ***Prog*** menu appears.
   b. Press the ***Scroll*** button until the Segment number 3 is displayed (***Seg.n 3***).
   c. Press the ***Scroll*** button.
   d. Enter the segment type (***tYPE***). Use the Up/Down buttons to enter a *ramp time* (***rmP.t***) type.
   e. Press the ***Scroll*** button twice.
   f. Enter the target setpoint (***tGt***). This is the 48000 at 4800 of the ramp, expressed in units of Lbf/10. (For example, 48000 Lbf = 4800)
   g. Press the ***Scroll*** button to display duration parameter (***dur***).
   h. Enter the dur time (min) using the up button.
   i. Press the ***Page*** button 4 times to exit.

Note: For low compressive strength samples 8.0-12.0 min is the recommended duration. For high compressive strength samples 2.0-3.0 min is the recommended duration.

10. Place the press direction control switch in the UP position.

11. Increase the controller output to 1.0% by pressing the UP arrow button. The press will rise, contact the upper platen and stop. The press will then hold in an idle position for 20-30 seconds.

12. While the press is in idle decrease the controller output to 0.0% by press the DOWN arrow button.

13. Wait for the press to engage the hydraulics. An audible change in pump rate will be heard.

14. Place the controller in automatic (AUTO) mode. By pressing the AUTO/MAN button The AUTO indicator will illuminate.

15. Start the program using the steps below.

a. Press the RUN/HOLD button. The RUN indicator will illuminate.
b. The program will increase the applied force to 150 Lbf (15 x 10) clamping force in 30 seconds.
c. The program will hold the 150 Lbf clamp force for another 30 seconds.
d. The program will begin applying the chosen rate of force.

16. The sample will crush at its peak compressive strength.

17. When the sample fails, the controller will automatically terminate the program and remain in the standby state. The message "4rat" will flash indicating a "rate of change" alarm has occurred.

    If a sample fails gradually, without a sudden fracture, the controller may not automatically terminate the program. In this case, the operator must manually stop the program by pressing and holding the RUN button for three seconds or longer. In the event that the operator manually stops the program the peak value is not stored on the display.

    To stop the press manually:
    a. Place the press direction control switch in the OFF position. This will stop the press from rising.
    b. Reset the controller by pressing and holding the RUN/HOLD for three seconds or longer. This will reset and idle the controller. The RUN and HOLD indicators will extinguish.
    c. Press the AUTO/MAN to switch from automatic (AUTO) mode to manual (MAN) mode. The MAN indicator will illuminate.

18. Reset the rate alarm on the controller by pressing PAGE and SCROLL together.

19. Place the press direction control switch in the DOWN position to lower the platen for cleaning.

20. Place the press direction control switch in the OFF position.

21. Open the safety door, dispose of the sample.

22. Clean both the upper and lower platens.

Interpreting the Results

API Cement Compressive Strength Test

To calculate the compressive strength of a sample, the peak load at which failure occurred must be determined. The peak value is obtained from the display or from graphical data (if a data acquisition system is used). The peak value is divided by the sample cross-sectional area to obtain the compressive strength using the following equation:

$$Compressive\ Strength = \frac{Maximum\ Load}{Sample\ CrossSectional\ Area}$$

If a standard ASTM cement cube is used, the cross-sectional area is 4.0 in^2 (2 inch x 2 inch cube). To obtain the Compressive Strength in psi, divide the Maximum Load value by 4.0.

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Section 3 – Maintenance

Maintenance Schedule

MAINTENANCE SCHEDULE Model 4207D Digital Compressive Strength Tester					
COMPONENT	EACH TEST	MONTHLY	3 MONTHS	6 MONTHS	ANNUAL
Oil	Check Level				Every two years, change the oil
System Pressure					Check the system pressure, adjust to 2600 psi
Press Assembly (See procedure below)					Perform maintenance checks below
Hydraulic Power Unit (See procedure below)					Perform maintenance checks below
High Temperature Limiting Circuit					Verify operation
Platen Control Switch			Adjust as needed		
Load Cell			Calibrate		
This maintenance schedule applies to normal usage of two tests per day. Detailed procedures for these operations are contained in your manual.					

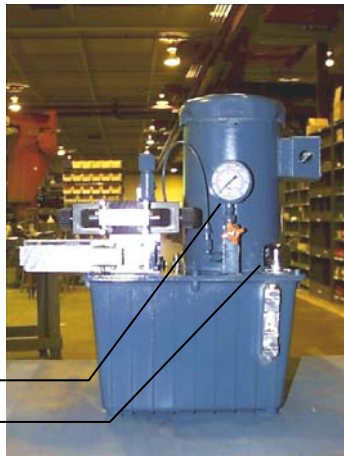
Filling the Oil Reservoir

The system reservoir will not require refilling unless the oil is drained or a leak occurs. The oil should be changed every two years. To fill the reservoir, use the following procedure:

1. Remove the reservoir fill cap.

2. Fill the reservoir using *10W30* synthetic oil. Verify that the oil is not contaminated. **Do not reuse old oil.**

3. Fill the reservoir until the oil level is mid-range on the sight gauge on the front of the reservoir.



Adjusting the System Pressure

The system pressure must be set to a value greater than the maximum pressure required by the system to create the anticipated loads. Use the following procedure to adjust the system pressure:

Note: The system pressure will decrease as the oil temperature increases. For this reason, adjust the system pressure when the oil temperature is at or near room temperature.

1. Verify that the system temperature is below 80°F (27°C).
2. Turn the system ***On***.
3. Place the cylinder control switch in the ***Up*** position.
4. Locate the relief valve adjustment and the system pressure gauge.
5. Adjust the relief valve until the system pressure gauge equals 2,600 ±200 psig.
6. Place the cylinder control switch in the ***Off*** position.
7. Tighten the relief valve lock nut.

Resetting the Maximum Temperature Limit

This system is equipped with a circuit that disables the hydraulic power unit if the oil temperature exceeds 70°C. The circuit must be manually reset for continued operation of the system.

To reset the temperature limit, press the red reset button located on the right panel.

Use the following procedure to adjust the maximum temperature limit:

1. Turn the system ***Off***.
2. Remove the back panel from the power unit.
3. Locate the temperature limit circuit board located on the left side of the enclosure (viewed from the rear).
4. Locate the calibrated dial on the circuit board. Adjust the knob to a value of 70°C.
5. To reset the temperature circuit, press the ***Red*** reset button located on the right panel.
6. To test the circuit, turn the system ***On*** then adjust the temperature set point below the oil temperature. Verify that the relay opens and an *LED* illuminates. Adjust the set point and press the ***Reset*** button.

Maintaining the Press Assembly

Use the following procedure to inspect the condition and safety of the press assembly:

1. Verify that the door limit switch is operational.
2. Inspect the cylinder and repair any leaks.
3. Inspect the hydraulic hoses and replace if signs of deterioration exist.
4. Inspect the upper and lower platens. The top platen must be level with respect to the base.
5. Inspect the columns on the press. Do not use the press if the columns are damaged in any way.
6. Inspect the load cell mandrels and replace if damaged or deformed.

Maintaining the Hydraulic Power Unit

Use the following procedure to inspect the condition and safety of the hydraulic power unit assembly:

1. Verify that the oil level is within the limits of the sight gauge on the reservoir.
2. Test the operation of the high temperature limiting circuit. Verify that the set point is 70°C.
3. Locate and repair any hydraulic leaks.
4. Verify that the fans located at the back of the enclosure are functioning.
5. Verify that the system hydraulic pressure is set at 2,600 psig. If pressure in less than 2,000 psig ± 200, see *Adjusting System Pressure* located in this section of the manual.

Adjusting the Platen Control Switch

The platen control switch is used to reduce the load on the sample as the sample is initially clamped. The platen assembly is equipped with a brass platen that is connected to a limit switch located above the steel top platen. As the sample is clamped, clearance between the brass and steel platens is used to close a switch that suspends the control program and hydraulics.

Once the sample is clamped without causing excessive initial loading, the program is restarted.

The limit switch may require periodic adjustment. Use the following procedure to adjust the limit switch:

*Warning: Make sure the instrument power is **off** before performing this procedure.*

1. Remove the cover plate from the limit switch assembly.

2. Bend the arm on the limit switch until the switch closes with an audible "click" as the brass platen is manually lifted. The switch must close before the brass platen touches the steel platen.

3. Manually operate the top limit switch and verify that the time delay relay inside the power unit trips with an audible "click." The delay is set to approximately 20 seconds by adjusting the knob at the top of the relay.

4. Replace the cover plate.

Calibration

Load Cell and Display and Controller Calibration

The display provides the excitation voltage for the load cell. The load cell calibration factor (mV/V x the Excitation Voltage) is used as the scaling factor for the display.

The display and controller calibration is based on the calibration certificate provided with the load cell and the excitation voltage (+10Vdc).

If the instrument must be recalibrated, an independent load cell must be loaded into the press and used to validate the output of the load cell in the instrument.

1. To calibrate the load cell, use an independent measurement of the load, preferably traceable to a primary standard. Create a load of approximately 10,000 to 50,000 pounds-force. Record the exact value.

2. Measure the excitation voltage from the display on terminals 1A and 1B at the back of the display. Note this voltage.

3. Measure the output of the load cell corresponding to the known load at terminals V+ and V-. The value will measure as millivolts (*mV*).

4. Divide the load cell output by the excitation voltage. This value is the new calibration factor for the load cell, expressed in *mV/V*. Adjust the calibration factor by the ratio of the measured load to 50,000 Lbf. The result will be the calibration factor at full scale (50,000 Lbf).

$$\frac{Load\ Cell\ Output\ (mV)}{Exec\ Voltage\ (V)} = Cal\ Factor\ (\frac{mv}{v})$$

5. Update the calibration factor used in the display and controller. Follow the manufacturers instructions for updating the factor. (CONFIG – IP menus).

Controller Calibration

The controller uses the same load cell signal that is used by the display. For this reason, they use the same calibration factor.

1. Obtain the new load cell calibration factor. Multiply the value in *mV/V* times the display excitation voltage.

$$Cal\ Factor * Exec\ Voltage = Load\ Output$$

2. Enter the controller or display ***Config*** mode. Navigate to the ***IP*** menu and enter the ***InP.H*** value with the calculated load cell output corresponding to 50,000 Lbf (displayed as 5000). This value must equal the calibration factor used by the load cell display.

3. Exit the controller ***Config*** mode.

4. Enter the controller ***IP*** menu. Adjust the ***OFS.1*** offset value until the displayed value with zero load on the load cell is **0**. This may require some trial and error.

5. Test the system to determine that the controller and display indicate the same load value. Note that the value displayed by the controller must be multiplied by 10 to obtain Lbf. The display indicates in units of Lbf directly.

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Section 4 - Troubleshooting Guide

Symptom	*Reason*	*Action*
Press does not operate.	Load frame door is open.	Close the load frame door.
	Over-temperature circuit has disabled the system.	Reset the over-temperature circuit by pressing the red button on the side panel.
	Controller is not programmed correctly.	Verify the program in the controller.
	Controller is not running.	Press the ***RUN*** button to start the program.
	Cable to the press is disconnected.	Connect the cable.
	Cylinder control switch is in off position.	Set the cylinder control switch to the ***UP*** position.
	Door or top platen limit switch is defective or requires adjustment.	Adjust door limit switch to close when the door is closed. Adjust the top platen control switch to close before brass platen touches the steel platen.
	Time delay relay is defective or not configured correctly.	Verify the time delay relay is set to operate with approx. 20 sec delay.
	Servo valve and/or related electronics are defective.	Contact Chandler Engineering service department.
Press will not reach programmed load.	Incorrect controller program.	Verify the program in the controller.
	Oil temperature is too hot.	Allow the oil to cool and repeat the test.
	System pressure is set too low.	Allow the oil to cool and verify that the system pressure is set at 2,600 psig.
	Over-temperature circuit is improperly adjusted.	Set the over-temperature circuit to operate at 70°C.
Displayed load values are incorrect or display's different values.	Controller or display calibration is incorrect.	Reconfigure the display or controller with the system calibration factors.
		Recalibrate the display and controller.
		Press the ***Tare*** button on the display.

Symptom	*Reason*	*Action*
		With zero load, adjust the ***OFS.1*** offset value in the controller ***IP*** menu until the value agrees with the load display.
Control program does not end when a cube fails.	Controller "rate of change" set point is incorrect.	Set the set point value for alarm 4rat to 5500 or higher.
Sample fails prematurely.	Initial sample load is excessive.	Check the adjustment of the top platen limit switch. Adjust the top platen control switch to close before brass platen touches the top platen. Verify the time delay relay is set to approx. 20 seconds.
	Sample was not placed in the center of the platen.	Relocate the sample and repeat the test.
Serial communication problems.	Incorrect cable.	Verify the serial communication connections.
	Controller or display is not configured for serial communication.	Insert communication module and reconfigure the controller for Modbus communication with I/O address = 1. Display I/O address = 2.

Section 5 - Replacement Parts

Part Number	Description
07-0176	Thermocouple Assembly
7052	Controller
89-0022	Base, Painted
89-0150	Panel, Front
89-0155	Mandrel, Top, Load Cell
89-0156	Mandrel - Bottom - Load Cell
89-0181	Power Cable Assembly
89-0190	Load Cell Assembly
89-0191	Rod/Plate Assembly
C07685	Switch, Limit
C08126	Switch, 3-Way
C08439	Cable, DB25S-DB25P
C08466	Power Supply, 24vdc
C08586	Transformer, 230/115VAC
C08889	Fan, Cooling, 230VAC
C08890	Guard, Fan
C08975	Converter, RS485 to RS232
C09041	Module, Controller Relay
C09043	Module, RS485 (used in controller and display)
C09492	Load Cell & Display (Cooper display & load cell)
C09493	Module, Controller DC Output
C09500	Oil, Motor, 10W-30 Synthetic (Qt)
C09504	Relay, Time Delay
C09693	Display
C11148	O-ring
C11149	Filter Element
C12059	Thread Sealant, Loctite
P-1130	Fuse, 1A
P-1662	Fuse, 2A
P-2209	Switch, Pushbutton
P-3336	Latch/Knob
P-3387	Switch, Circuit Breaker
P-3431	Relay, Solid-State, DC Control

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Section 6 – Drawings and Schematics

Document Number	Description
N/A	Controller Configuration
89-0151	Wiring Diagram
89-0170	4207D Pump Connections
89-0175	Procedure, 5270 Configuration

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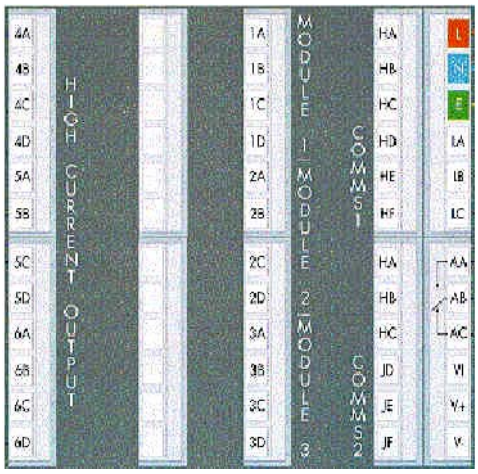
Controller Configuration

The controller chassis will slide out of the back shell by loosening the clips at the right and left front of the controller front panel. The controller is installed in the panel of the instrument using two plastic clips located behind the panel. The clips may be removed with a small screwdriver and the controller and back shell may be removed from the panel.

Please refer to the following illustration for the location of the electrical connections to the controller:



Model 4207D Controller Electrical Connections		
Terminal	**Description**	**Comment**
L	Power input – L1	85 – 264 VAC, 50/60 Hz
N	Power input – H (L2)	
G	Chassis ground	
V+	Input (+)	From Load Cell
V-	Input (-)	From Load Cell
HD	Comm1 – digital ground	Used with 5270 option
HE	Comm1 – A+ (RS485)	Used with 5270 option
HF	Comm1 – B- (RS485)	Used with 5270 option
1A	DC output (+)	0-10Vdc - used to control hydraulic unit servo valve
1B	DC output (-)	0-10Vdc - used to control hydraulic unit servo valve
3A	Alarm contact	Alarm contact drives the digital input LA
3B	Alarm contact common	Alarm contact drives the digital input LA
LA	Digital input	Used to shut down a program when cube breaks
LB	Digital input	Used to shut down a program when cube breaks
LC	Digital input common	Used to shut down a program when cube breaks

Model 4207D Controller Configuration Parameters			
Parameter	**Description**	**Status**	**Value**
RUN	Program Run List	Hide	
PROG	Program Edit List	Altr	
Hb	Holdback type	Hide	OFF
Hb.U	Holdback units	Hide	0
rmP.U	Ramp units	Hide	min
dwL.U	Dwell units	Hide	min
CYC.n	Number of program cycles	Hide	1
SEG.n	Segment number		varies depending on segment being configured
TYPE	Segment type		varies depending on segment being configured
AL	Alarm List	Altr	
4rat	Alarm 4 rate limit alarm	Altr	6000 (may require adjustment during final system testing)
HY4	Alarm 4 hysteresis	Hide	1
Lbt		Off	
diAG	Enable diagnostic alarms	Hide	no
ATUN	Autotune List	Hide	
PID	PID List	Hide	
GSP	Not used		
SET	PID1 or PID2		PID1
PB	Prop. Band		5000
TI	Int. Time		3
TD	Der. Time		OFF
RES	Manual Reset		0
HCB	Cutback High		Auto
LCB	Cutback Low		Auto
REL.C	Rel. Cool Gain		1.0
SP	Setpoint List	Hide	
SSEL	Setpoint Select		SP1
SP 1	Setpoint 1 value		0
SP 2	not used		not used
SP L	SP1 low limit		0
SP H	SP1 high limit		5000
SP2 L	not used		not used
SP2 H	not used		not used
SPrr	Ramp rate value		Off
Hb.ty	Holdback type		Off
IP	Input List	Hide	
Fil.t	Filter time constant		5.0

Model 4207D Controller Configuration Parameters			
Parameter	**Description**	**Status**	**Value**
OFS.1			0
Lil.2	not used		
Hi.i	not used		
F.1	not used		
PU.iP	iP.1		iP.1
CAL	Factory/User Cal		FACT
CAL.S	calibration point		none
ADJ	not used		
OFS.1	IP1 cal offset		Varies with zero load output of load cell
OFS.2	not used		
mU.1	IP1 meas. Input		0
mU.2	not used		
CJC.1	CJC reading		N/A
CJC.2	not used		
Li.1	IP1 lin. Input		N/A
L1.2	not used		
PU.SL	selected PV input		N/A
OP	Output List	Hide	
OP.Lo	Low power limit		0
OP.Hi	High power limit		100
OP.rr	Output rate limit		OFF
FOP	Forced output level		0
CYC.H	Heat cycle time		0.20
End.P			0.0
Sb.OP	Sensor break output power		0
CMS	Comms List	Hide	
Addr	Instrument address, if comm. is used		1
INFO	Information List	Hide	
disp	Configure lower readout content		Stat
ACCS	Access List		
code	Access password		1
GoTo	Goto level		Oper/Edit/Conf
Conf	Configuration password		2
INST	Instrument Configuration		
Ctrl	Control type		PID
Act	Control action		Rev
Cool	Type of cooling		Lin
Ti.td	Int. & Der. Time units		Sec

Model 4207D Controller Configuration Parameters			
Parameter	**Description**	**Status**	**Value**
dTyp			PU
m-A	Front panel Auto/Man		EnAb
r-h	Front panel Run/Hold		EnAb
PwrF	Power feedback		Off
Fwd.t	Feed forward type		None
Pdtr	Manual/Auto transfer		No
Sbr.t	Sensor break output		Sb.OP
FOP	Forced manual output		Step
bcd	BCD input		None
GSch	Gain schedule		No
PU	Process Value Configuration		
unit	units		None
dec.P	decimal points		nnnn.
rng.L	Range low		0
rng.H	Range high		5000
IP	Input Type		
inPt	Input Type		mV
imP	Sensor Break impedance		Off
inP.L	Input value low		0
inP.H	Input value high		22.9 (will vary with load cell calibration) = Sensor Exc. Voltage x Sensor mV/V Value from Calibration Certificate ***See Instructions Below***
VAL.L	Displayed reading low		0
VAL.H	Displayed reading high		5000
SP	Setpoint Configuration		
nSP	Number of setpoints		2
rm.tr	Remote track		OFF
m.tr	Manual track		OFF
Pr.tr	Programmer track		OFF
rmP.U	Setpoint rate limit units		Pmin
rmt	Remote setpoint conf.		None
AL1/2/3/4	Alarm Configuration		
AL4	Alarm n type		rat
Ltch	Latching		man
PROG	Programmer Configuration		
PtyP	Programmer type		1
HbAc	Holdback		Prog
Pwr.F	Power fail recovery		rSEt

Model 4207D Controller Configuration Parameters			
Parameter	**Description**	**Status**	**Value**
Srvo	Starting setpoint of a program		to.SP
LA	Digital Input 1 Configuration		
id	Identity		LoG.i
Func	Function of input		Stby
LB	Digital Input 2 Configuration		
id	Identity		LoG.i
Func	Function of input		rES
HA	Comms 1 Configuration		
id	Identity of module		CmS
Func	Function		Modbus (if 5270 is used)
bAud	Baud rate		9600
dELy	Delay		No
PrtY	Comms parity - only Modbus		None
rES	Comms resolution - only Modbus		Full
1A/B/C	Module 1 Configuration		
Id	Identity of module		Dc.OP
Func	Function		OP
VAL.L	Minimum output		0
VAL.H	Maximum output		100
Unit	Unit of measurement		volt
Out.L	Minimum average power		0
Out.H	Maximum average power		10.0
2A/B/C	Module 2 Configuration		
id	Identity of module		none
Func	Function		none
VAL.L	Minimum output		0
VAL.H	Maximum output		0
Out.L	Minimum average power		0
Out.H	Maximum average power		0
3A/B/C	Module 3 Configuration		
id	Identity of module		rELy
Func	Function		dig
SEnS	Digital output sense		nor

Model 4207D Controller Configuration Parameters			
Parameter	**Description**	**Status**	**Value**
Alarm 1	Alarm 1 active		YES
Alarm 2	Alarm 2 active		no
Alarm 3	Alarm 3 active		no
Alarm 4	Rate of change alarm		YES
mAn	Controller in manual mode		no
Sbr	Sensor break		YES
SPAn	PV out of range		no
Lbr	Loop break		no
Ld.F	Load failure alarm		no
Tune	Tuning in progress		no
dc.F	Voltage output open circuit		no
rmt.F	PDSIO related		no
Nw.AL	New alarm has occurred		no
End	End of program		no
Sync	Program sync.		no
CAL	Calibration		
PASS	Password Configuration		
ACC.P	Full or Edit level password		1
cnF.P	Configuration password		2

1. The scaling of the controller input must be set using the calibration data for the load cell. Locate the calibration certificate for the load cell from the manufacturer. Determine the mV/V calibration factor:
2. Measure the load cell excitation voltage located across pins 1A and 1B at the back of the display. This value should be near +10 Vdc.
3. Calculate the full scale output of the load cell corresponding to 50,000 lbF using the following equation:

$$Full\ Scale\ Output = Cal\ Factor \times Excitation\ Voltage$$

4. Enter this full scale output value in the CONF – IP - inP.H location in the controller setup.

Display Configuration

The following table contains the default configuration for the load cell display.

FULL MENUS		**Comment**	***CONFIG MENUS***		**Comment**
HOME			INST		
dSP.F	PV	Displays the present value on the front display	unit	None	No Engineering units
dSP.b	PV.Hi	Displays the peak value on the back display	dEc.P	nnnn.	5-digit display
Cid	0.0	ID number	Ac.bu	Enab	Front panel Ack/Reset button
AL			IP		
1___	0.0	Not used	inP.t	mV	Input type
2___	0.0	Not used	CJC	N/A	Not used
3___	0.0	Not used	imP	Auto	Input impedance
4___	0.0	Not used	tYPE	Ld.C	Load cell calibration
	0.0	Not used	bAnd	0.01	Settling band
SP			inP.L	0.0	Low input value
SP L	0.0	Set Point Low Limit	inP.H	24.4	Varies with load cell calibration. Must be equal to same value in controller
SP H	50000	Set Point High Limit	VAL.L	0.0	Low calibration value corresponding to low input value
			VAL.H	50000	High calibration value corresponding to low input value
IP					
FiL.t	STEP	Step filter type	AL		
Int.t	N/A	Not used	AL 1	OFF	Not used
StP.b	1.0	Step filter band	Ltch		
OFS.1	Varies	/alue with no load	bLoc		
OFS.2	N/A	Not used	AL 2	OFF	Not used
Lo.IP	N/A	Not used	Ltch		
Hi.IP	N/A	Not used	bLoc		
F.1	N/A	Not used	AL 3	OFF	Not used
F.2	N/A	Not used	Ltch		
PU.iP	iP.1	Selects input 1	bLoc		
EmiS	N/A	Not used	AL 4	OFF	Not used
Emi.2	N/A	Not used	Ltch		
PU.SL	iP.1	Shows the selected input	bLoc		
CAL 1			LA		
tArE	OFF	Not used	id	LoG.I	Not used
CAL.P	3	Calibration password	Func	None	
cmS			LB		
Addr	2	Modbus I/O Address	id	LoG.I	Not used
			Func	None	
INFO					
LoG.L	Read Only	Minimum process value	AA		
LoG.H	Read Only	Maximum process value	id	rEL.Y	Not used
LoG.A	Read Only	Average process value	Func	None	
LoG.t	Read Only	Time process value above threshold value	SEnS		
LoG.u	0.0	Process value threshold	AL 1		
rES.L	No	Changing to "Yes" resets the peak value in Modbus Register 133	AL 2		
			AL 3		
			Al 4		
			Sbr		
			SPAn		
			rmt.F		
			iP1.F		

FULL MENUS		Comment	*CONFIG MENUS*		Comment
			nw.AL		
			HA		
			id	cmS	Communication module installed
			Func	mod	Modbus protocol
			bAud	9600	Baud rate
			PrtY	No	Parity
			dEL.Y	None	Response delay
			rES	Full	Resolution
			JA		
			id		Not used
			Func	None	
			VAL.L		
			VAL.H		
			1A		
			id	SG.SU	Strain gage power supply installed
			Func	IP.1	Bridge supply for input 1
			brG.U	10	10 Vdc Bridge power
			SHnt	Int	Internal shunt
			2A		
			id		Not used
			Func	None	
			3A		
			id		Not used
			Func	None	
			CAL		
			rCAL	None	Not used
			PU		
			PASS		
			ACC.P	1	Access password
			cnF.P	2	Configuration password
			CAL.P	3	Calibration password

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
C2	T	ECN T3006; UPDATED LOAD CELL CONNECTION	6/2/10	TC
C2	U	ECN T5513; ADDED 89-0190	9/17/13	TC
B6	V	ECN T6029; CHANGED TRANSDUCER CONNECTION	6/17/14	TC

FUSE TABLE
F1 = P-1662
F2 = C01184
F3 = P-1662
F4 = C01184
F5 = C01184

P-3387 CIRCUIT BREAKER
14 YEL
230 VAC POWER
14 RED
14 YEL
14 RED
14 RED
18 YEL
18 YEL
18 WHT
230VAC
18 RED
C08586 TRANSFORMER
120VAC
18 BLK
18 WHT
18 RED
18 BLK
14 RED
14 YEL
18 RED
18 YEL
18 YEL
18 RED
18 RED
22 BLK
22 RED

C08889 FAN
C08889 FAN
18 YEL

5X C10901 BLK, YEL
2X C10900 BLK, RED
8X C10904 JUMPER
3X C10905 PLT, END
5X C10906 FUSE BLK
2X P-1662 FUSE, 2A
3X P-1130 FUSE, 1A
C07994 DIN RAIL 3"

P-2209
22 WHT
22 WHT
OVER TEMPERATURE THERMOCOUPLE IMMERSED IN HYDRAULIC OIL 07-0176

C11062
(NO)
(COM)
(NC)
18 RED

22 RED
22 ORG
18 BLK
3 SSR P-3431
C08126
DOWN
OFF
UP
B A
DIRECTIONAL VALVE
18 BLK

Z P/Q CARD B

Z		B
2	z2 +24V	2
4	z4 0V Power ref	4
6	z6 +15V/100mA	6
8		8
10		10
12		12
14		14
16	z16 test point 0...10v	16
18		18
20		20
22	z22 Q set point 0...+/-10V	22
24		24
26		26
28		28
30	z28 ext. P-controller disconnection 6...40V	30
32	z32 Potentiometer +10V supply	32

b2 0V Signal ref
b8 ground
b10 controller disconnect 0...40V
b12 P set point 0...10V
b14 P set point 0V ref
b22 Q set point 0V ref
b24 4...20mA signal
b28 0V signal ref

22 BLK
22 WHT
22 GRN
22 BLK
22 RED
22 BLU
22 WHT
22 BLK

PQI-1 0811405157
DIL 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
ON
OFF

SERVO VALVE
0811404600 Valve
A +24V
B 0V
C 0V ref
D 0...+/-10V Signal
E 0V Signal ref
F LVDT Signal 0...+/-10V
SL Chassis Ground
22 RED
22 BLK
22 WHT
22 GRN
PROPER SHIELDING REQUIRED

C08466 POWER SUPPLY
+24 VDC
+5 VDC
+5 VDC
Common
Common
22 BLK
22 RED
18 RED
18 YEL
18 RED
18 YEL
22 GRN
P-2051 (OPTIONAL)

C08931
1A LINE
1B N
1C GND
1D HD LA
2A HE LB
2B HF LC
2C AA
2D AB
3A AC
3B
3C V+
3D V-
22 GRN
22 WHT
22 GRN
22 YEL
22 YEL
22 YEL
22 RED
22 WHT
22 GRN

P-0371 (OPTIONAL)
22 GRN
22 BLU
22 ORN
22 BLK
22 RED

C09693-LOAD CELL DISPLAY
MODULE 3: 3D 3C 3B 3A
MODULE 2: 2D 2C 2B 2A
MODULE 1: 1D 1C 1B 1A
SIGNAL: V- V+ VI
RELAY: HF HE HD
DIG. INPUTS: AC AB AA
POWER: HC HB HA LC LB LA GND N L
22 GRN
22 WHT

INSTALL THE FOLLOWING MODULES
C10497-STRAIN GAGE POWER SUPPLY MODULE
C09043-COMM MODULE
C09041, DC OUTPUT MODULE

RECORDER OUTPUT
V+
V-
RS485 GND 7
C08975 A+ 2
B+ 14
DB25S P-2438
NOTE: INSTALL C09043 MODULE IN CONTROLLER IF DATA COMM OPTION IS REQUIRED.

USE HEAT SHRINK TUBING ON ALL SOLDERED CONNECTIONS
P-3062 4 EA
P-3084

DB25S P-2438
22 GRN
22 WHT
22 BLK
22 RED
22 WHT
22 WHT/BLU
LOAD CELL 89-0190
PLATEN
DOOR
C07685
NC C NO
NC C NO
22 WHT
22 WHT/ORG
LIMIT SWITCHES
PRESS ASSEMBLY

22 GRN
22 WHT
22 BLK
22 RED
22 BLU
22 BLU
22 ORG
22 ORG
C08439
DB25P P-2437
22 ORG

22 BLU
22 BLU
RELAY FUNCTION SETTING: C020S

C09504 - RELAY
C09505 - SOCKET
22 YEL
22 YEL
22 ORG
22 BLK
22 RED
TO 24VDC SUPPLY

PUMP MOTOR
MOTOR MUST RUN CW WHEN VIEWED FROM TOP

P U
1 U+
2 N/C
3 U-
4 S+
BRN
WHT
BLU
BLK
4 CONDUCTOR CABLE
PRESSURE TRANSDUCER

C09494 - HYDRAULIC SYSTEM - 60HZ MOTOR
C09924 - HYDRAULIC SYSTEM - 50HZ MOTOR

NOTE: HYDRAULIC PUMP MUST BE DRIVEN IN CW DIRECTION. CONNECT POWER TO THE MOTOR AS FOLLOWS:
L1 - WIRE 1
L2 - WIRES 4, 8
JOIN WIRES 2, 3, 5

NOTE: REFERENCE PROCEDURES 89-0152, 89-0153 FOR CALIBRATION AND SETUP.
ALL DC SIGNAL WIRING TO BE ROUTED SEPARATELY FROM AC POWER WIRING.

	4207D
NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]
TOLERANCES:
1 PLACE ±0.030 [.76]
2 PLACE ±0.010 [.25]
3 PLACE ±0.005 [.127]
ANGLES ±1/2°
SURF. FINISH 32

APPLICATION

APPROVALS		DATE
DRAWN:	AEB	11/12/99
CHECKED:	BD	10/16/01
ENGR.:	JJM	01/24/01

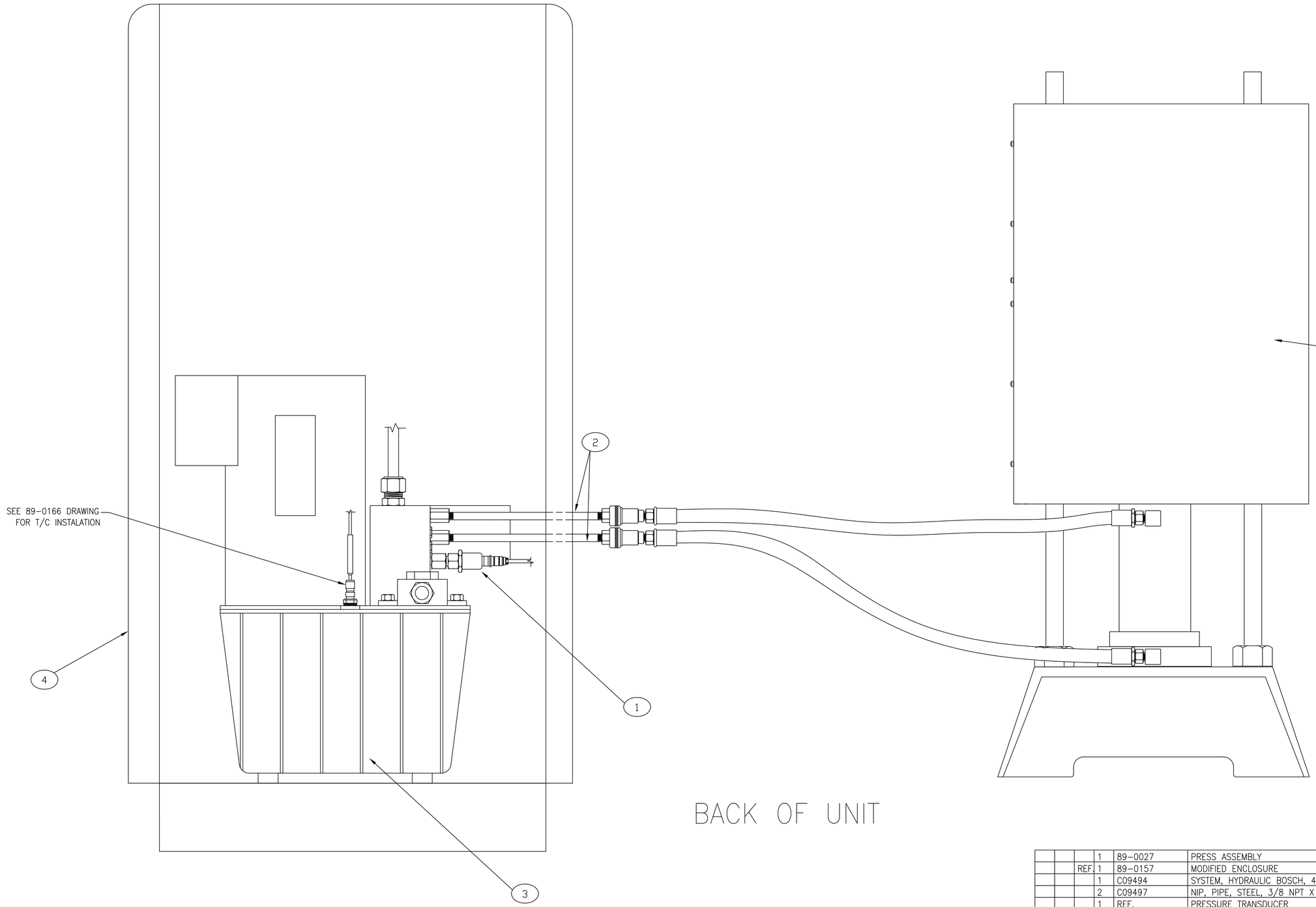
CHANDLER ENGINEERING

TITLE
WIRING DIAGRAM
MODEL 4207D

SIZE	S.O. NO.	DWG NO.	REV.
A2		89-0151	V

SCALE: 1 = 1 | DO NOT SCALE DRAWING | SHEET: 1 of 1

REVISIONS					
ZONE	REV	DESCRIPTION OF REVISION	DATE	APPROVALS	
	A	ISSUED, ECN 7241	01/22/01	JAC	BD
	B	ECN 7343, PLUMBING REVISIONS	04/10/01	JAC	JH



BACK OF UNIT

-04	-03	-02	-01	PART NUMBER	DESCRIPTION	MATERIAL SPEC.	ITEM
			1	89-0027	PRESS ASSEMBLY		5
		REF.	1	89-0157	MODIFIED ENCLOSURE		4
			1	C09494	SYSTEM, HYDRAULIC BOSCH, 4207D		3
			2	C09497	NIP, PIPE, STEEL, 3/8 NPT X 8 L		2
			1	REF.	PRESSURE TRANSDUCER		1

QTY. REQD. — PARTS LIST

NEXT ASSY: 4207D — USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]

TOLERANCES:
1 PLACE ±0.030
2 PLACE ±0.010
3 PLACE ±0.005
ANGLES ±1/2°
SURF. FINISH 63

CHANDLER ENGINEERING

TITLE: 4207D PUMP CONNECTIONS

APPROVALS		DATE
DRAWN:	JAC	01/22/01
CHECKED:	JH	01/22/01
ENGR.:	BD	01/22/01

SIZE	S.O. NO.	DWG NO.	REV.
A1		89-0170	B

SCALE: 1 = 1 — DO NOT SCALE DRAWING — SHEET: 1 of 1

TITLE: Procedure, 5270 Configuration for 4207D
Instrument Model: Model 4207D Compressive Strength Tester

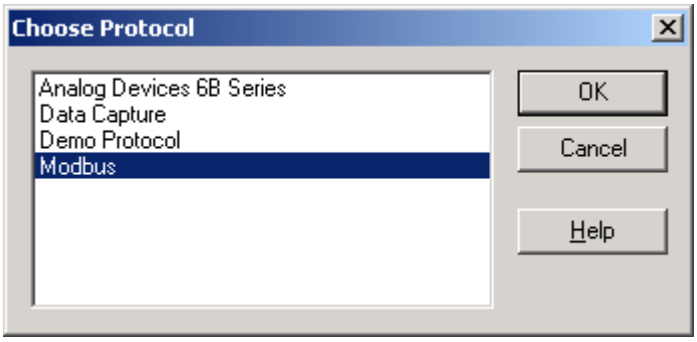
Revision	Date	Revised By	Description	Checked By
B	10/01/09	AMH	ECN T2532	TC

The Model 4207D Compressive Strength Tester may be used with the Model 5270 Data Acquisition and Control System (DACS). The following procedure is used to configure 5270 for use with this instrument. The following features are available:

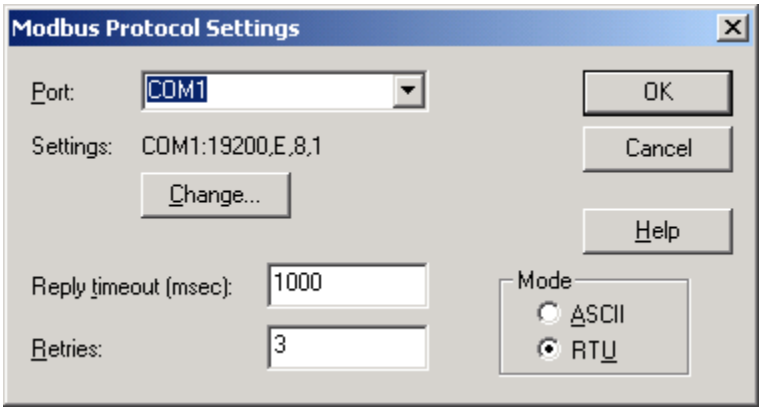
- Acquisition of peak value from the load display
- Acquisition of the programmed value from the controller
- Download of API Fast and Slow load rates to the controller
- Automatic reset of the load display peak value when a new 5270 test is started

NOTE: The latest version of the 5270 DACS software must be used for all features to be supported. At this writing, the most recent version of 5270 is 1.10.097. If an upgrade is needed, please contact AMETEK Chandler Engineering at 918.250.7200

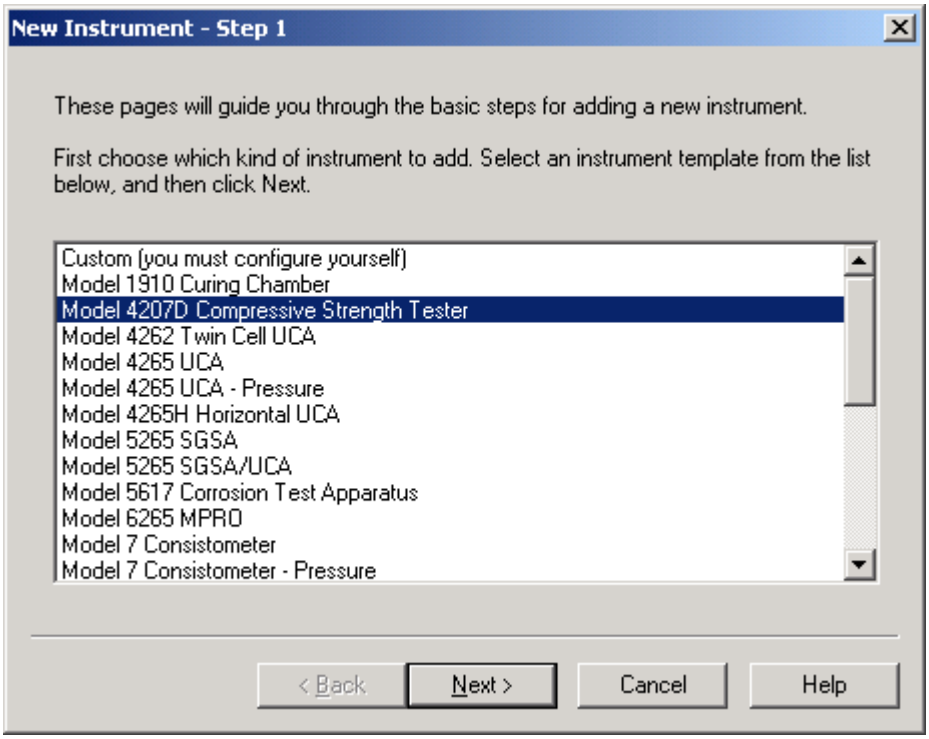
Using Tools – Configure – I/O Connections, configure an I/O connection using the Modbus protocol.



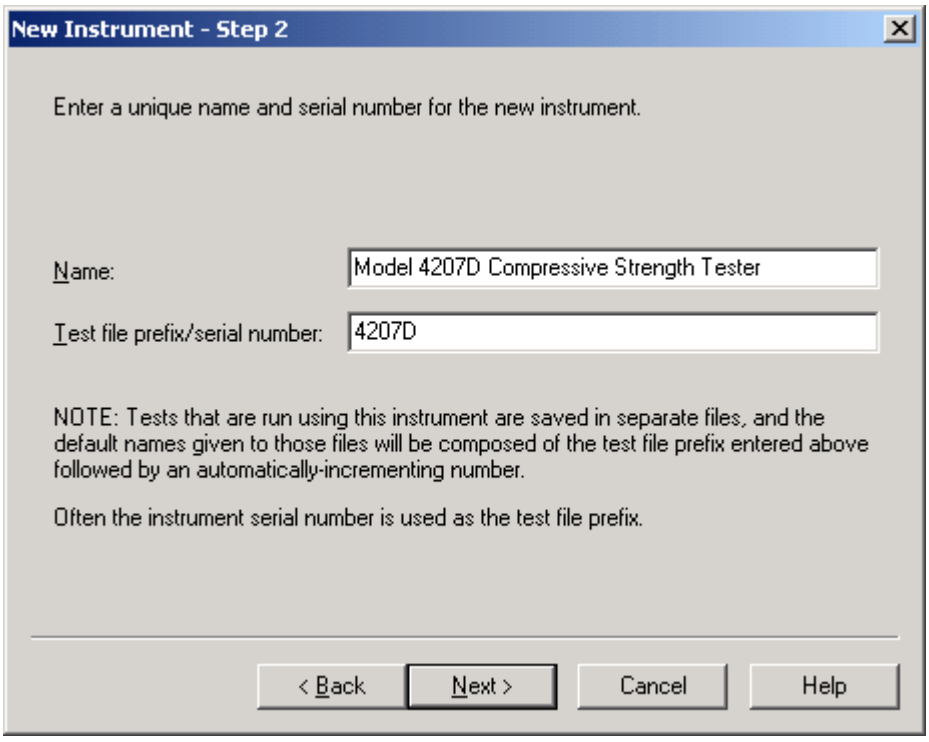
Select the COM port that is connected to the 4207D instrument. COM1 is illustrated; however, the actual port assignment may vary as required by the hardware configuration.



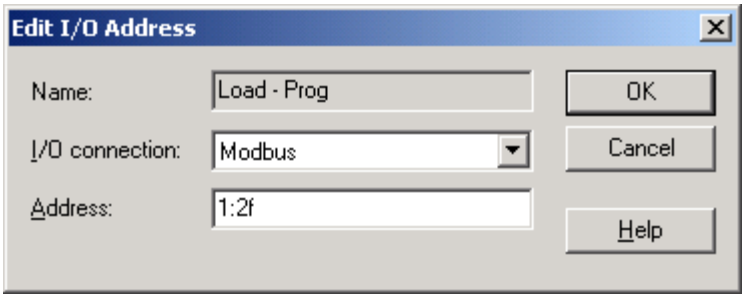
Using Tools – Configure – Instruments, select the Model 4207D Compressive Strength Tester from the list of available instruments.

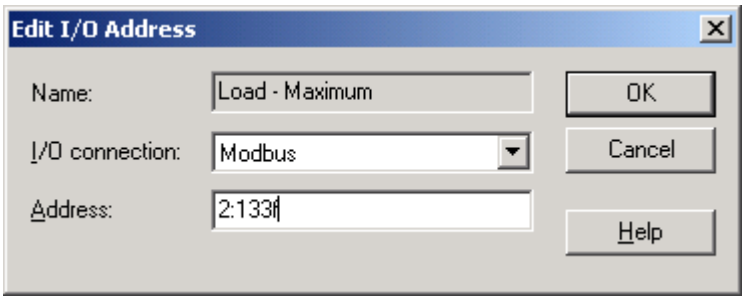


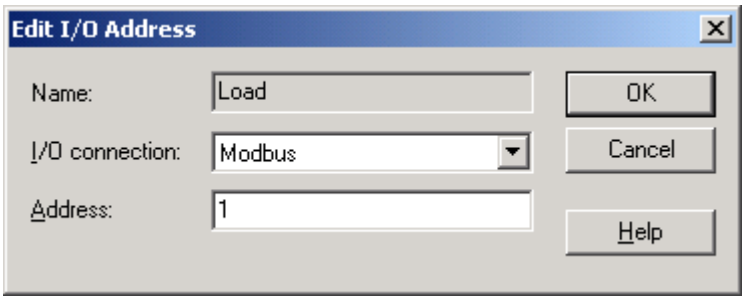
Assign a name and file prefix. These choices may vary as desired.

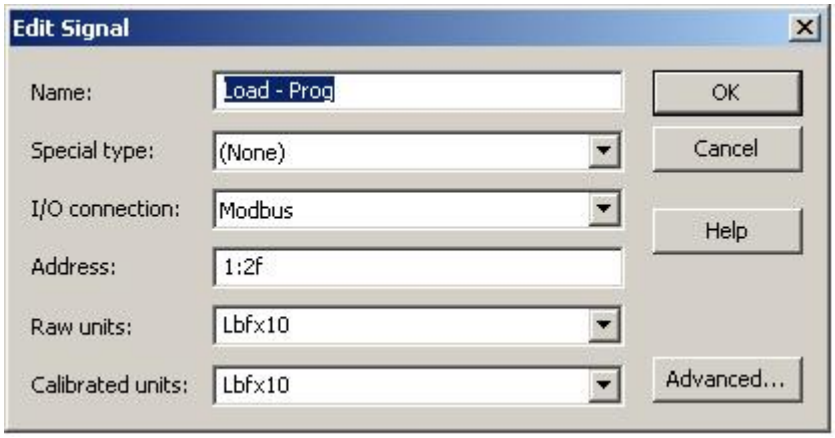


Define the signal I/O addresses as shown. Note that the address for the controller (Load – Programmed) is 1:2f to acquire the programmed load, the address for the peak value (Load – Maximum) from the load cell is 2:133f. The address for controller program downloads (Load) is 1.

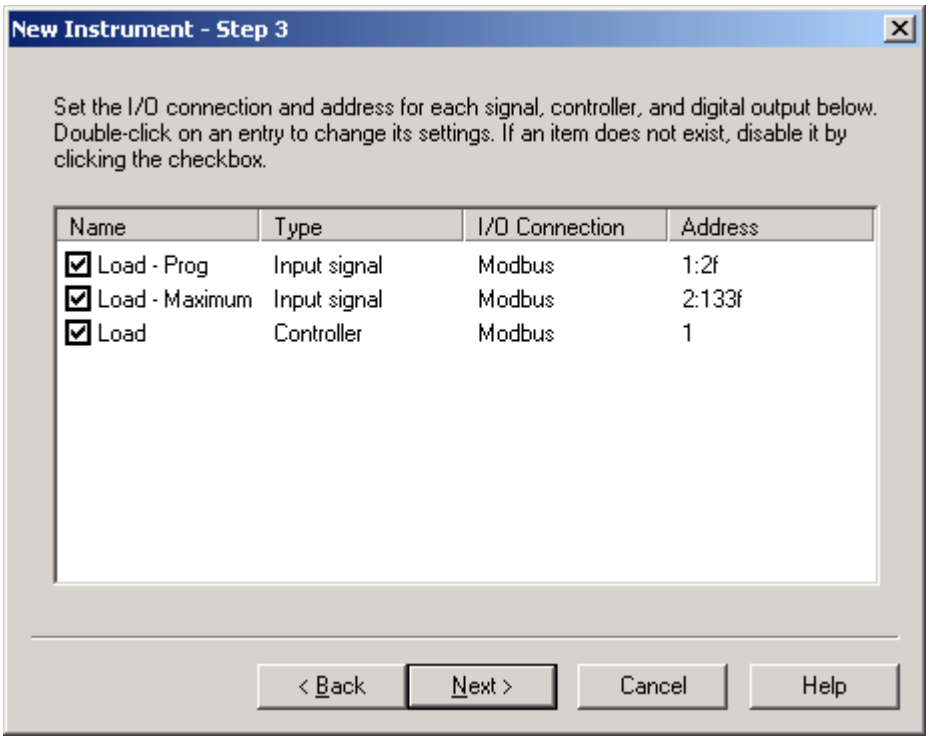






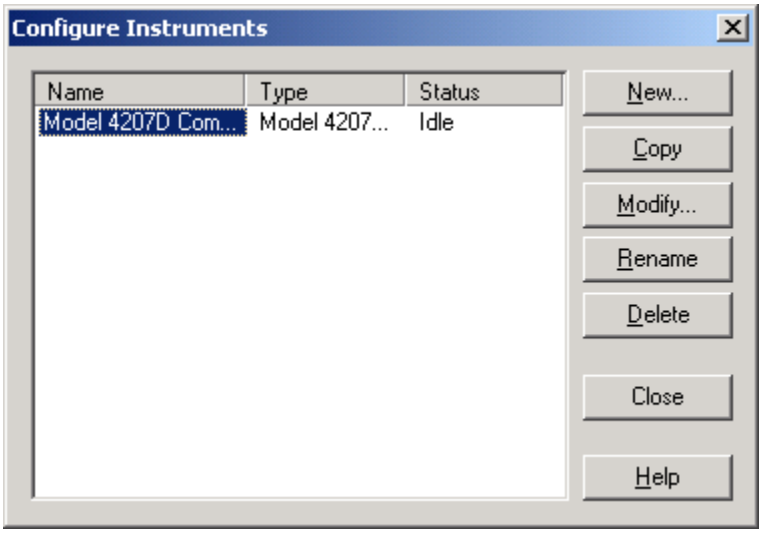


Verify that the signal I/O address assignments agree with the following:

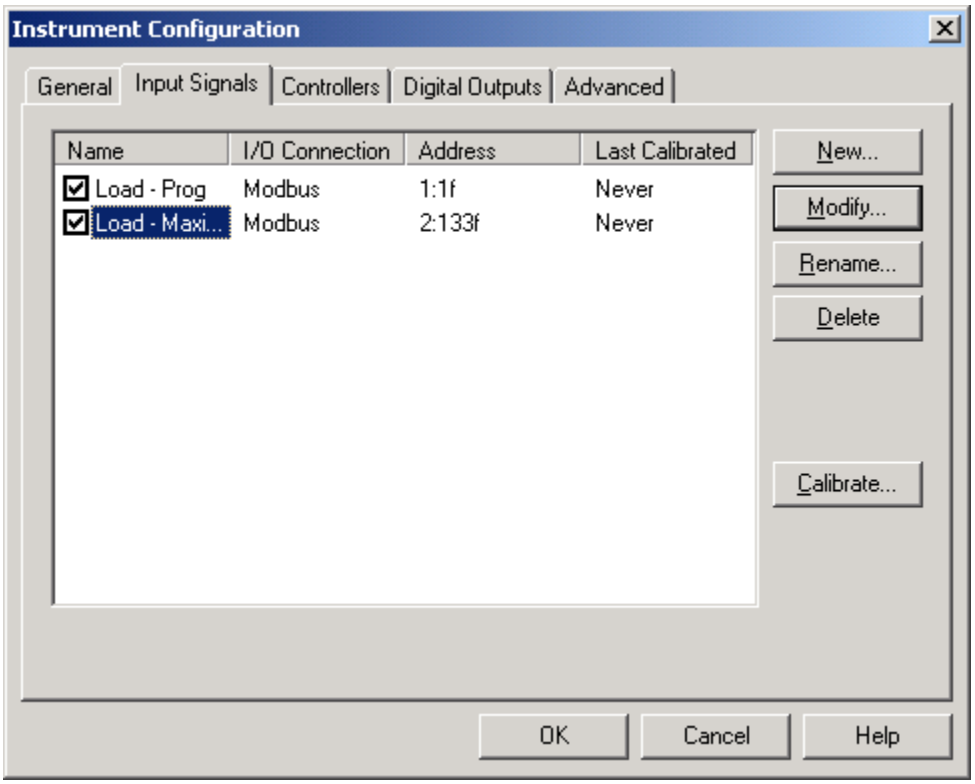


Once this is complete, the Load – Maximum signal must be configured to provide automatic reset of the peak value when a test is started on 5270.

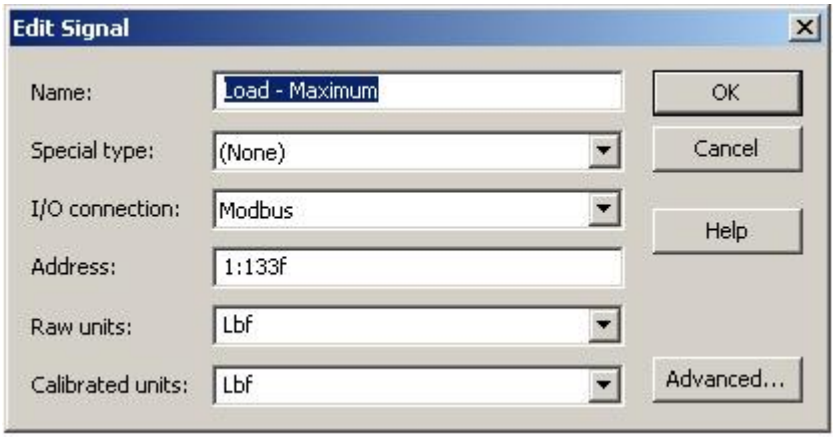
Select Tools – Configure – Instruments. Select the Model 4207D instrument.



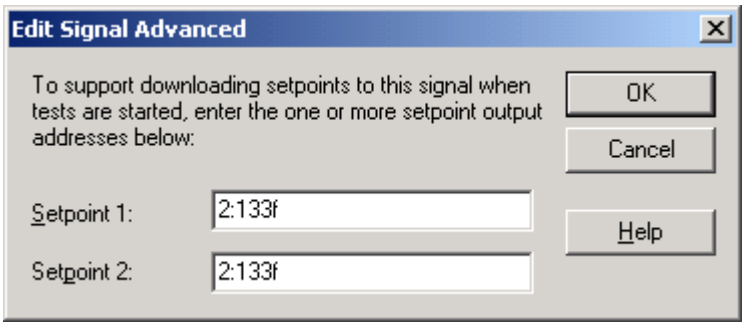
Select the Load – Maximum signal as illustrated.



Select Modify.

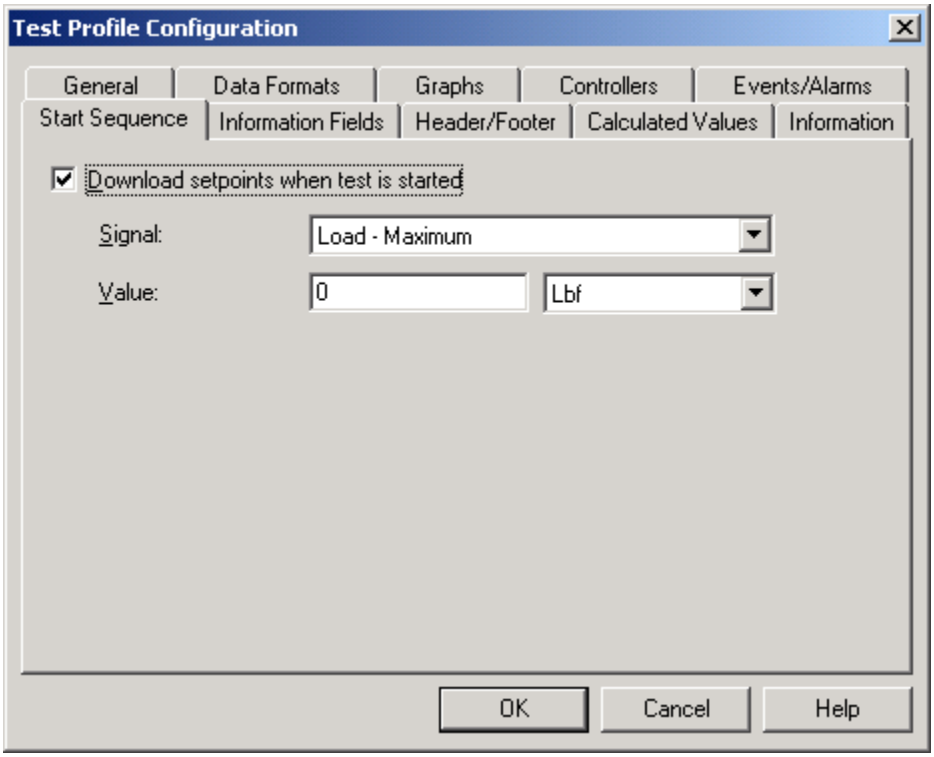


Select the Advanced option.

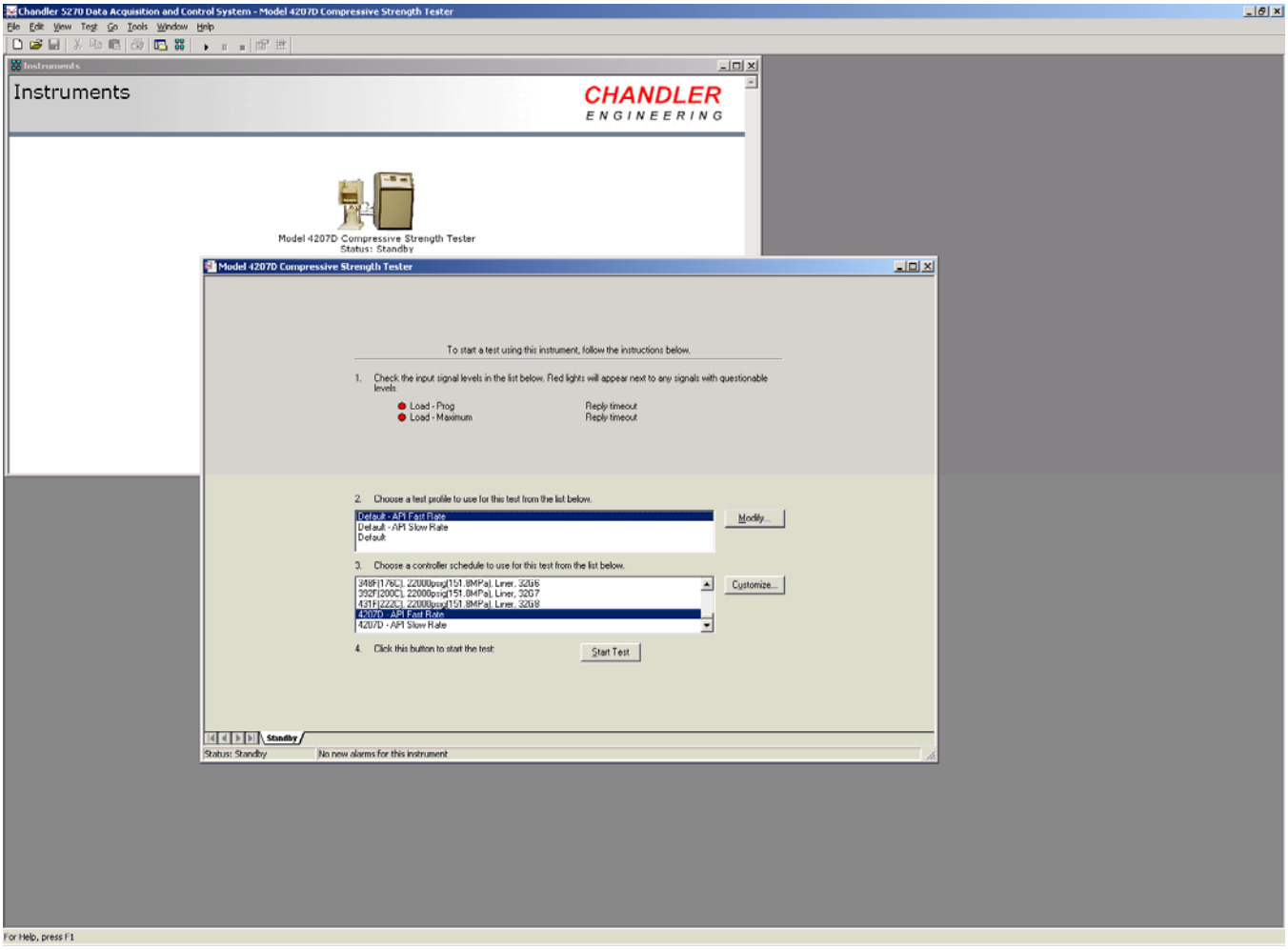


Change the Setpoint 1 and Setpoint 2 values to 2:133f as shown. This action directs 5270 to download a 0.00 value to the display when a test is started. The “0.00 Lbf” value is already defined in the test profiles for this instrument in the Start Sequence section of the Test Profile.

Select Tools – Configure – Test Profiles. Select the 4207D instrument and select one of the profiles (note that the default profiles may not be changed, a copy must be made). Select the Start Sequence option and verify that the “Download setpoints when test is started” option is enabled, the Signal is set to Load – Maximum and the Value is 0.00 Lbf.



When a test is started using 5270, the following display appears (disregard the RED signal indications, on an actual instrument they must be GREEN)



Select the desired API loading rate from the pre-defined test profiles.