



SUPERVISOR II SEQUENCING & PROTOCOL MANUAL

Part Number 02250057 – 696
eSullair Corporation

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SECTION 1.1 SUPERVISOR II PROTOCOL VER 3.0

This document describes features that are more technical in nature than the normal operation of the machine, in particular sequencing and communication.

The Supervisor II communications link is a RS-485 (two wire) serial line. The following three parameters must be set correctly to be able to communicate through this link.

COM ID#	Unique number for each machine on the link.
BAUDRATE	Must be the same for all machines (default is 9600).
SEQUENCE	Sequencing mode (see below).

The function of the link is specified by the setting of the Sequence parameter as follows :

DISABLED	Responds to status and parameter change messages but will not respond to messages to start, stop, load or unload.
REMOTE	Responds to status and parameter change message but will not respond to messages to start, stop, load or unload. The remote inputs and outputs are enabled (start/stop, load/unload, master/local).
SLAVE	Will respond to all messages, but will not start or load unless commanded to do so by a message. This mode is used to control the machine from a master computer.
HOURS	Sends net status message about once a second, starts, loads and unloads machines based on sequencing hours.
COM ID#	Sends net status message about once a second, starts, loads and unloads machines based on machine Com ID#.

If the sequence parameter is set to Hours or Com ID# then the following parameters must be set (see section on Sequencing Methods) :

LAST COM	Highest Com ID#
LOWEST	Lowest line pressure before starting machine.
RECOVER	Recovery time.
ROTATE	Machine rotation time.
CAPACITY	Capacity of the machine.
SEQ HRS	Sequencing hours.

NOTE

See Sequencing (Section 2) for detailed descriptions of sequencing parameters and operation. Messages can be sent between Supervisor II controls and to/from a computer. There are two modes of operation, query and broadcast.

If the sequence parameter is set to **DISABLED**, **REMOTE**, or **SLAVE** then the query mode is enabled. The Supervisors will only send messages in response to a message from the host computer. In **DISABLED** and **REMOTE** the Supervisor controls the machine locally (ie. start, stop load, and unload) and will ignore any messages to start, stop, load or unload. Only status and parameter change messages will be acted on. In **SLAVE** mode the Supervisor will not start, stop, load or unload unless a message commands the action.

If the sequence parameter is set to **HOURS** or **COM ID#** then the broadcast mode is enabled. In this mode the machines send the net status message periodically. Approximately once a second, all machines that are on line will send a net status message. In this manner, each machine knows the status of every other machine. Sequencing decisions are made individually by each machine based on the status of all on line machines in the system. Collisions on the serial channel are avoided by a time slice scheme (See section on Time Slice).

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BROADCAST MODE OFFERS SEVERAL ADVANTAGES :

1. Because there is no master, the number of messages are cut in half (decreasing response time). In master/slave mode the master must send a message to request status and the machine must send a message back. In broadcast mode, each machine sends it's status approximately once a second.
2. When a machine goes off line or on line there is no need to poll for a new master.
3. Individual machines may be taken off line or put on line with no effect on communications. This is handy for maintenance or when a machine is to be controlled manually. When the machine is stopped it still sends net status messages so other machines or a monitor can display it's status. When the machine is DISABLED it will not send net status messages but will respond to status and parameter change messages.
4. Because decisions are made locally, the response of the system is very good, less than one second for trimming, loading and unloading. One second plus starting time for a machine to start.
5. There are no extra communications for monitoring. Since each machine sends it's status every second, the monitor does not need to send messages. However, the monitor may send messages to get other status, change parameters or issue run commands (for example a machine may be stopped from the monitor).
6. The monitor does not need to be continuously connected. A monitor may be connected or disconnected at any time.

MESSAGE FORMAT

All messages will have the following format.

@	Start of text (2)
##	Two character com number
m	One character message type
d	Zero to several data characters (values separated by comma's)
xx	Two character check sum
CR	Carriage return (13)
LF	Line feed (10)

For the following examples the **STX**, **CR** and **LF** will not be shown.

MESSAGE TYPES

The following messages sent by the sequencing master to slaves:

MESSAGE TYPE	FORMAT	EXAMPLE
Q – Quick status	##Qxx	01Q4E
S – Stop	##Sxx	01S4C
U – Unload	##Uxx	01U4A
L – Load (Modulate)	##Lxx	01L53
F – Full load	##Fxx	01F59
T – Trim (Modulate)	##Txx	01T4B
E – Emergency Stop	##Exx	01E5A

If a machine is stopped U, L, F or T will start the machine.

The slave response to these messages is:

MESSAGE TYPE	FORMAT	EXAMPLE
q – Quick status	##q1,2,h,r,mxx	01q0,115,2000,M,C65

1 is Capacity, 2 is P2, h is Run Hours, r is Run Status and m is Mode

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RUN STATUS (r)

E – E–Stop	
M – Manual Stop	m – Manual stop & Common Fault
R – Remote Stop	r – Remote stop & Common Fault
B – Standby	b – Standby & Common Fault
S – Starting	s – Starting & Common Fault
U – Unloaded	u – Unloaded & Common Fault
L – Loaded	l – Loaded & Common Fault
T – Trim	t – Trim & Common Fault
F – Full load	f – Full load & Common Fault

MODE (m)

A – Auto run mode, remote start/stop enabled.
a – Auto run mode, remote start/stop disabled.
C – Cont run mode, remote start/stop enabled.
c – Cont run mode, remote start/stop disabled.

The following messages sent by machines when the system is in stand alone sequencing :

MESSAGE TYPE	FORMAT	EXAMPLE
N – Net status	##N1,2,h,r,mxx	01N0,115,2000,M,C88
M – Monitor Enable	##Mxx	01M52

1 is Capacity, 2 is P2, h is Run Hours, r is Run Status and m is Mode.

The following messages are sent by the monitor:

MESSAGE TYPE	FORMAT	EXAMPLE
G – Get parameter	##Gn,xx	01G3,58
P – Change parameter	##Pn,v,xx	01P3,4,90
D – Display message	##Dxx	01D5B
I – Status info	##Ixx	01I56
A – Auto run mode	##Axx	01A5E
C – Cont run mode	##Cxx	01C5C

In the change parameter message n = number and v = value.

- 1 Machine type (read only)
- 2 Machine options (read only)
- 3 Language (0=French, 1=German, 2=Italian, 3=Spanish, 4=English)
- 4 Units (0=Metric, 1=English)
- 5 Unload pressure
- 6 Load pressure
- 7 P1 Max pressure
- 8 Off load time (0–15 min.)
- 9 Wye–Delta time (0–10 sec.)
- 10 Drain interval time (0–30 min.)
- 11 Drain time (0–10 sec.)

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12 Restart time	(0–60 sec.)	45 T6 CAL	(–7 to +7)
20 Machines	(1 – 8)	46 P1 CAL	(–7 to +7)
21 Sequence method	(0–Disabled, 1–Remote, 2–Slave, 3–Hours, 4–Com ID)	47 P2 CAL	(–7 to +7)
22 Sequence hours	(0–30,000)	48 P3 CAL	(–7 to +7)
23 Lowest pressure		49 P4 CAL	(–7 to +7)
24 Recover time	(2–30 sec.)	50 dP1 CAL	(–20 to +10)
25 Capacity	(0–10,000)	51 P3 MAX	(–7 to +7)
26 Rotate Time	(10–250 hrs.)	70 Parameter Protection	(0 = NOT Protected, 1 = Protected)
40 T1 CAL	(–7 to +7)	71 Shutdown on warning	(0 = Warning, 1 = Shutdown)
41 T2 CAL	(–7 to +7)		
42 T3 CAL	(–7 to +7)		
43 T4 CAL	(–7 to +7)		
44 T5 CAL	(–7 to +7)		

Parameter protection inhibits the changing of any parameters via the Supervisor keyboard. This protection can only be enabled and disabled through the serial channel.

The shutdown on warning feature shuts the machine down on alarms that normally only display a message. This feature can only be enabled and disabled through the serial channel.

The slave response to the above messages is:

MESSAGE TYPE	FORMAT	EXAMPLE
p – Parameter changed	##pn,v,xx	01p5,1003D
g – Parameter status	##gn,v,xx	01p5,1003d
d – Display message	##dm,mxx	01d E–STOP, 0 72DE
i – Status info	##id,....,ddxx	
q – Quick status	##q1,2,h,r,mxx	01q0,0,E,C66

The parameter changed message sends the value of the parameter back after the change was attempted. It may not have been changed if it was out of legal range.

Status info message sends the status in the following order:

- | | |
|-------|--|
| 1. P1 | 10. T6 |
| 2. P2 | 11. Analog shut/down (See Table Below) |
| 3. P3 | 12. Digital outputs (BIT 0=K1, BIT 1 =K2, ETC.) |
| 4. P4 | 13. Digital shut/down (BIT 0=D1, BIT 1=D2, ETC.) |
| 5. T1 | 14. Digital inputs (BIT 0=D1, BIT 1=D2, ETC.) |
| 6. T2 | 15. Run Time |
| 7. T3 | 16. Load Time |
| 8. T4 | 17. Run Status |
| 9. T5 | 18. Mode |

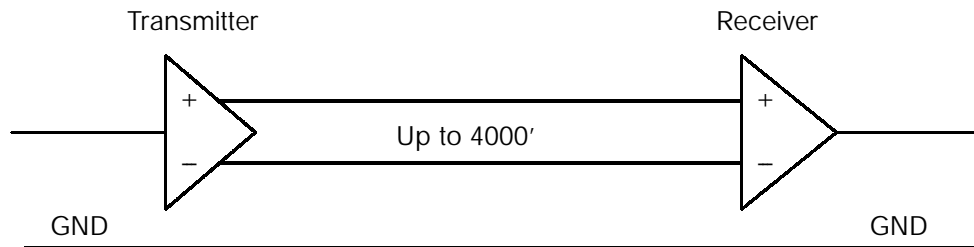
ANALOG SHUTDOWN TABLE

1=P1	6=dP2	11=T4
2=P2	7=dP3	12=T5
3=P3	8=T1	13=T6
4=P4	9=T2	
5=dP1	10=T3	

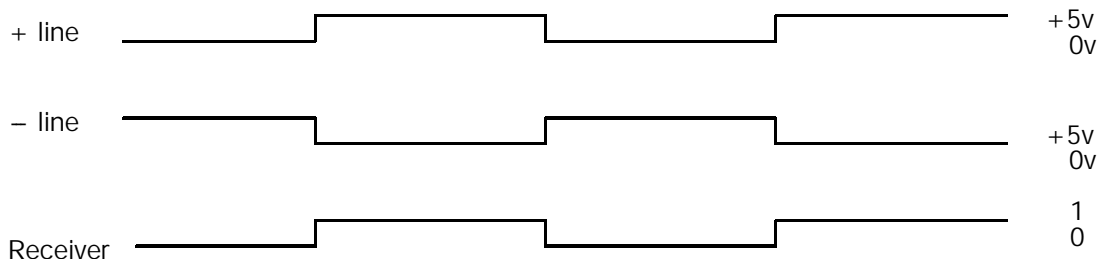
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RS-485 SERIAL CHANNEL

The RS-485 is a party line type channel, ie. any device on the channel may transmit or receive on the same wires. The transmitters and receivers are differential type that use two wires and a ground. These have very good noise immunity because the receiver measures the voltage between two signals, and not between a signal and ground (as RS-232 does). If noise occurs on both lines it will be rejected by the receiver. The ground is used to keep the receiver from floating too high above the transmitter.



A one is transmitted as 5 volts on the + line and 0 volts on the - line. A zero is 0 volts on the + line and 5 volts on the - line.



The transmitters are tri-state, meaning they can drive the transmission line to a one (5 volts), zero (0 volts) or be turned off (high impedance). All transmitters except one must be in tri-state mode, otherwise the transmission will be garbled and damage to the transmitters can occur.

TIME SLICING OF THE RS-485 SERIAL CHANNEL

When the sequencing mode is set to HOURS or COM ID# the machines will broadcast their status (net status message) about once a second. To keep machines from sending messages simultaneously, time is sliced into periods (up to 9 maximum), one for each machine and one for a monitor. A machine will only send a net status messages during it's time slice (see table below).

Time Slot	COM ID#	Time out
0	Monitor	.5 sec
1	1	.125 sec
2	2	.125 sec
3	3	.125 sec
4	4	.125 sec
5	5	.125 sec
6	6	.125 sec
7	7	.125 sec
8	8	.125 sec

The number of time slots is determined by the LAST COM parameter. If the LAST COM parameter is set to 4 then there will be 5 time slots (0 thru 4). One for each machine and one for the monitor.

The time slot for a monitor is longer because it may not be able to respond as quickly to a message as

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the Supervisors.

The Supervisors establish what the current time slot is by either receiving messages or timing out. Any net status message establishes the time slot because the senders COM ID# is imbedded in the message. For example if a net message from machine 2 is received then time slot 2 has just finished and 3 is started.

If there is no message for a time out period (see table above) then it is assumed that the machine assigned to that time slot is off line and the next time slot starts.

A machine sends a net status message immediatly after a message is received from the next previous machine, or that machines time slot has expired. For example if the time slot has been established as 2 and either machine 2 sends a net status message or no message is sent within .125 seconds, then machine 3 will send a net status message (if on line).

During time slot 0 a monitor may send a message, typically a status request or parameter change message. A message that is sent by the monitor may need a response from one of the machines. This response must come before the time out period (.5 sec).

Consider the following system with 4 machines with no monitor and machine 3 is off line.

Time Slot	COM ID#	Status	Action
0	Monitor	Off line	.5 sec time out
1	1	On line	Machine 1 net message
2	2	On line	Machine 2 net message
3	3	Off line	.125 sec time out
4	4	On line	Machine 4 net message

Let's start this example at time slot 1. Machine 1 sends a net message. Machine 2 receives the message and establishes the time slot as 2. Machine 2 immediatly sends it's net status message establishing the slot at 3. Since machine 3 is off line no message will be sent and after .125 sec. the time slot will rotate to 4. Machine 4 will send it's net status message, and the time slot will roll over to slot 0. Since there is no monitor, after .5 sec. the time slot will rotate to 1 and machine 1 will send it's net status message. This cycle will repeate until other machines go off or on line. When a machine is switched on line or powered up it does not know what the time slot is until it receives a net message from another machine. If only one machine is put on line, or multiple machines are powered up at the same time, none of them will know what the current time slot is. To overcome this deadlock the following scheme is used.

When a machine comes on line it waits for an initial timeout period of 1.5 seconds times it's COM ID#. For example if it's COM ID# is 4 then it will wait 6 seconds. If a message is received during the initial timeout period then the time slot will be known because the senders COM ID# is imbedded in the message. For example if a net message from machine 2 is received then the time slot is 2.

If no messages are received within the initial timeout period then a net message is sent. It can be assumed that either there are no other machines on line or that they have been put on line at the same time and are waiting for their initial timeout to expire. This keeps several machines that are powered up at the same time from all sending net status messages simultaneously.

Section 2

SUPERVISOR II SEQUENCING

2.1 SUPERVISOR II SEQUENCING

NOTE: Read the operation manual and be familiar with machine operation before reading this document. This section only deals with sequencing and knowledge of stand alone operation is required prior to sequencing.

Sequencing Modes

The purpose of the sequencing software is to allow up to eight machines in a system to be started or stopped depending on one of several selectable methods. The method used for sequencing is selected by changing the sequencing parameter to the desired mode. (See section on CHANGING SEQUENCING PARAMETERS).

The sequence modes are :

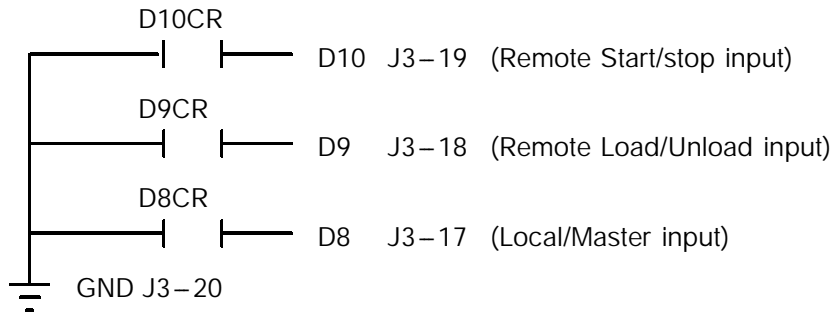
DISABLED – Select this mode if you do NOT want the machine to do automatic sequencing. When this mode is selected the machine will run as a stand alone machine. If the continuous button is pushed the machine will start immediately (if there are no faults). If the machine is stopped and in auto, it will start when the pressure drops below the load point. The machine will respond to status and parameter change messages but not to messages that command start, stop, load or unload and will not broadcast a net status message.

REMOTE – This mode is provided to facilitate control from a system that uses hard contacts for control (such as a PLC) instead of the serial channel. The machine will respond to status and parameter change messages but not to messages that command start, stop, load or unload and will not broadcast a net status message.

There are three inputs and one output that are enabled in this mode:

- Remote Start/Stop Input (D10)**
- Remote Load/Unload Input (D9)**
- Local/Master Input (D8)**
- Local/Master Output (K6)**

Inputs D8, D9 and D10 are wired through relay contacts to ground.



If D10CR is closed the machine will be enabled to start, if D10CR is open the machine will stop, and be held stopped. If remote start/stop is not needed then jumper D10 (J3-19) to GND (J3-20).

The following table describes how the other inputs work:

Local/Master	Load/Unload	Operation
Open	Open	Normal load and unload
Open	Closed	Force unload
Closed	Open	Force load, unload at P1 max – 3
Closed	Closed	Force unload

The Local/Master Output is on when the Local/Master Input is on and the machine is not in E-stop or Stop. If the Local/Master output is on the display will have two stars (**) in the middle of the bottom line. The Local/Master Output is a relay contact that can handle 110VAC at 6 amperes. (J1-14 & J1-15)

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SLAVE – This mode is used when the Supervisor II is to be controlled by a computer via the serial channel. The machine will not broadcast a net status message but will respond to any message from the master computer including messages that command start, stop, load, unload, trim and full load. The machine must be commanded to load and unload. It will not load and unload at the setpoints. However, as a safety it will unload when sump pressure (P1) is over P1 MAX – 3.

HOURS – In this mode machines are started and loaded depending on the SEQUENCE HOURS parameter. The sequence hours parameter is similar to run hours except that it can be changed. Two other parameters, LOWEST PRESSURE and RECOVERY TIME must also be set.

The LOWEST PRESSURE parameter is set to the lowest pressure allowed before a machine is started (usually set 5 to 10 psi (.3 to .7 bar) below LOAD PRESSURE). If the system pressure drops below this limit then the machine with the lowest run hours is started immediately. A machine will also start if the pressure is below the load pressure for a period of time. The length of this time is 0 to 120 seconds depending on the pressure. The closer the pressure is to LOWEST PRESSURE the shorter the time. For example if the pressure drops below the load pressure by 1 psi (.07 bar), and stays there a machine will start in 120 seconds. If the pressure drops near LOWEST PRESSURE then a machine will start in just a few seconds.

The RECOVERY parameter determines how long a machine waits to start or load after the previous machine in the sequence starts or loads. This time is needed to keep multiple machines from starting or loading at the same time. The shorter this time is the more responsive the system is, the longer the time, the more energy efficient the system is. If a machine starts because of low pressure, and the pressure stays low the next machine will start in 15 seconds plus recovery time. If a machine loads and the pressure does not go above the load pressure the next machine will load after the recovery time.

Example: Three machines are in a system with the load pressure set at 100 psig (6.9 bar), unload at 110 psig (7.6 bar), lowest pressure at 90 psig (6.2 bar), and recovery time at 20 seconds. All machines are in sequence stop (top line of the display is SEQ STOP). When the pressure drops below 100 psig (7.6 bar) a timer starts counting down from 120 seconds, if the pressure drops the timer will count down faster. When the timer expires or the pressure drops below 90 psig (6.2 bar) the first machine is started. If the pressure does not go above 90 psig (6.2 bar) for 35 seconds (15 sec. plus recovery time). The next machine will start and so on until all machines are started.

As machines are started and loaded, there will be only one machine that is modulating, the others will be forced to full load. The modulating (trim) machine will load at 2 psi (.14 bar) above the load pressure parameter 102 PSIG(7.03 bar) in this example and unload at 2 psig (.14 bar) below unload pressure parameter 108 PSIG ((7.4 bar) in this example). The reason for this narrower load/unload band is to keep all machine from loading and unloading at the same time. The trim machine can be identified by looking at the main display, it is the machine that has two *'s between the pressure and temperature on line 2 of the display. If the pressure rises above the unload pressure – 2 psig (.14bar)(108psig (7.4bar)) the trim machine will unload and the next machine in the sequence will switch from full load to modulate. If after recovery time (20) the pressure is still above 108 PSIG (7.4 bar) then the trim machine will unload and so on until all machines are unloaded.

If the pressure falls below load pressure + 2 psig (.14bar) 102 psig (7.03 bar) the first machine in the sequence will load and be the trim machine, if after the recovery time (20) the pressure is still below 102 psig (7.03 bar) then the trim machine will go to full load and the next machine in the sequence will load and become the trim machine.

(See section on CHANGING SEQUENCING PARAMETERS for instructions on changing SEQUENCE HOURS, LOWEST PRESSURE AND RECOVERY TIME).

COM ID# – In this mode machines are started and loaded depending on the the COMMUNICATION NUMBER parameter. Operation is exactly the same as the HOURS method (see above) except the communications number is used to determine machine sequence instead of sequence hours.

CHANGING SEQUENCING PARAMETERS

To change parameters, push the program key until the top line of the display identifies the parameter to be changed. The up arrow and logo keys will increment the parameter value the lamp test will decrement. To save the changed value the program key must be pushed. The next parameter will then be displayed.

The following parameters may need to be changed for sequencing:

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COMID# – Must be unique for every machine in the system. If there are three machines in a system, for example, they must be numbered 1, 2 and 3.

BAUD RATE – Serial communications baud rate, almost always set to 9600.

LAST COM – Set to number of machines in a system.

LOWEST – Lowest allowable pressure. This should be set to the lowest allowable pressure before a machine starts. Normally this is 5 to 10 psi (.3 to .7 bar) below the load pressure.

RECOVER – Recovery time. This is the time that the next machine in sequence waits before starting or loading.

ROTATE – Rotate time. There are some systems where the trim machine never unloads or stops. For example a two machine system where one machine runs all the time and the other is used for backup. The rotate parameter forces the trim machine to stop (allowing the other machine to start). The trim machine will stop when its sequencing hours are more than a stopped machine sequencing hours by rotate hours.

For example, consider a two machine system with SEQUENCING hours of 1000 and ROTATE of 50 hours on each machine. If one machine is started and continuously loaded, it will run until its sequence hours are 1050 (50 hours more than the stopped machine) then stop. The other machine will start and run until its sequence hours are 1100 (50 more than the stopped machine) then stop, and so the machine will rotate back and forth every 100 hours.

CAPACITY – The capacity of the machine is sent in the net status message so that a monitor can determine system capacity. If the machine is loaded then the capacity number is sent other wise 0.

SEQ HRS – To change this parameter push the program key until SEQ HRS is displayed on the top line of the display. Pushing the logo key will increment by 1000 hours, the up arrow key will increment by 100 hours and the lamp test key will decrement by 100 hours. The number will roll over at 30,000 hours. To set the hours to a lower number it may be easier to push the logo key until the display reads 30,000, then hit the up arrow key, the display will then go to 0.

SYSTEM DISPLAY

There is a system display that may be helpful for trouble shooting, and calibration. While in the main display, push the logo key followed by the display key. The top line of the display should show the numbers 1 through the number of machines in the system (set by parameter LAST COM). The second line shows the status of each machine. If the status letter is lower case then the machine has a fault or warning. The status letters are:

E	E – Stop
M	Manual stop
L	Loaded
T	Trim (loaded and modulating)
F	Full load
U	Unloaded
B	Standby
R	Remote or sequence stop
S	Starting

If the up arrow key is pushed the system line pressure is displayed. If the up arrow key is pushed again the line pressure and run hours of the first machine is displayed, if the arrow key is pushed again the second machine is displayed and so on. The lamp test key changes to the previous display.

CALIBRATION OF P2 PRESSURE TRANSDUCERS

Because each machine has its own pressure transducer it is possible that after a long period of time these can read differently. If this happens the supervisors should be recalibrated.

This recalibration is best done when the system is at a stable pressure. Measure the pressure using an independent gauge, then change the calibration parameter for P2 so that the supervisor reads the same as the gauge.

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The changing of the calibration parameters is entered by a special key sequence to protect from inadvertent change. The key sequence is :

LOGO, UP ARROW, DISPLAY, LAMP TEST, PROGRAM

The first line of the display should read CAL P1, if not push the display key and try again. If the first line of the display reads CAL P1 push the program key, and the first line of the display should read CAL P2. The second line of the display will show the calibration parameter (+7 to -7) and the current P2 reading corrected by the cal parameter. The up arrow key will increase the reading and the lamp test will decrease the reading. Use these keys to correct the P2 reading, then push the program key. The program key must be pressed after setting the cal parameter to make it permanent. Return to the main display and check to make sure the pressure is correct.

SYSTEM SETUP AND TUNING

The following shows the settings for a system of low pressure 100–110 psig (6.9 to 7.6 bar) machines. The Trim High & Low Setpoints are not settable parameters, they are calculated from the Unload and Load pressures. The Trim High Setpoint is 2 PSI (.14 bar) below the Unload pressure and the Trim Low Setpoint is 2 PSI (.14bar) above the Load pressure.

100 psig (6.9 bar) Unload
98 psig (6.8 bar) Trim High Setpoint (calculated parameter)
92 psig (6.3 bar) Trim Low Setpoint (calculated parameter)
90 psig (6.2 bar) Load
85 psig (5.9 bar) Lowest pressure
5 Recover time (seconds)

Note that the unload pressure is set to 100 psi (6.9 bar) and not 110 psi (7.6 bar) as is normal on a stand alone machine. A stand alone machine set up at 100 psi (6.9 bar) to 110 psi (7.6 bar), starts to modulate above 100 psi (6.9 bar) and the horsepower is reduced. However in a system a machine may be forced to full load, which would draw more than the rated horsepower above 100 psi (6.9 bar). Therefore the modulation band of machines in a system should be set up to be 10 psi (.7 bar) lower than their rated pressure.

For energy efficiency reasons it is desirable to have all running machines either at full load or unloaded except for one which will hereafter be called the trim machine. The trim machine unloads when the line pressure rises above the Trim High Setpoint.

The Trim High and Low Setpoints are necessary because the trim machine must unload before the fully loaded machines and load before the unloaded machines, otherwise all machine would load and unload at the same time.

The Lowest pressure parameter specifies the lowest pressure allowed before immediately starting a machine. A machine may also be started if the line pressure drops below the Trim Low setpoint for a period of time.

The recovery time is used to keep multiple machines from loading, unloading or starting at the same time. A timer is reset when a machine loads, unloads or loads after a start. Decisions to load, unload or start, another machine are deferred until the timer reaches the recovery time setpoint. Note that the timer starts when a machine is added or taken away from the system. If the pressure recovers within the recovery time and then at a later time the pressure drops below the Trim Low setpoint, then another machine will load immediately. The shorter the recovery time the more responsive the system to load changes, but the less energy efficient it is because machines may not shut off as often. The more often a machine loads the less likely it is to stay unloaded and shut off after the unload timer expires.

In the following discussion 'highest' refers to the machine with the highest sequence hours or com num and 'lowest' refers to the machine with the lowest sequence hours or com num.

The following rules are used to load, unload and start :

1. Only the highest loaded machine will trim; the rest will be forced to full load.
2. The trim machine will unload when the line pressure rises above the Trim High setpoint, and after the recovery timer expires. The highest loaded machine will then become the trim machine.

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3. The lowest unloaded machine will load (trim) when the line pressure drops below the Trim Low setpoint, and after the recovery timer expires.
4. The lowest stopped machine will start when the line pressure drops below the Trim Low set point, and after a variable time out period. This time out is dependent on how far the line pressure is below the Trim Low set point. The farther below the set point the shorter the time to start.
5. The lowest stopped machine will start when the line pressure drops below the Lowest Pressure set point, and after the recovery timer expires.

2.2 INSTALLATION

NETWORK WIRING

The network cable should be Belden 9842 or similar. This cable has two twisted pairs with a shield. One twisted pair is connected to J2–16 and J2–17. Twisted pairs usually have one colored wire twisted with a black or white wire. Make sure that the colored wire is on J2–16 and the white or black wire is on J2–17. Both wires of the other twisted pair is connected to J2–18. The shield should be connected to ground at one end only.

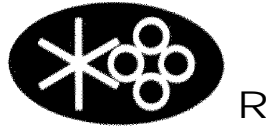
COMMON HEADER

It is best if the P2 (line pressure) transducer of all machines are connected to a common header, down stream of driers, etc. Note that the dP1 (separator maintenance delta pressure) may need to be calibrated to take into account the extra pressure drop of the down stream equipment.

FULL LOAD OPTION

The full load option puts a valve on the machine that forces the machine to full load. Spiral valve machines also require a relay that disables the spiral valve while in full load.

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