Chapter 6

INTRODUCTION

This section of the *289H Installation and Operations Manual* contains essays or documents that pertain to the setup, operation, and use of the 289H monitoring system. Most of the documents included here were originally published as Software Release Notes or are technical excerpts from the System Studies *Gazette* and *AirTalk* newsletters.

289H LSS CUTOVER PROCEDURES

As more and more cable pressurization system monitors are replaced by the 289H LSS, System Studies continues to receive tips and suggestions from the Field Technicians involved in the cutover process. The following procedure, which was developed using these tips, lists the steps necessary for a basic cutover. The pre-installation of relay cards and the automatic assignment of access numbers is the recommended procedure for converting to the 289H LSS. This procedure may need to be modified and customized to fit your particular needs. Please note that there are several different ways to convert an office for 289H installation. These depend upon the type of existing monitor being used, the size of the office, whether a straight cutover can be performed, etc. Also note that since the 289H does not read volume counters, these devices must be upgraded to flow transducers. Please contact System Studies prior to your conversion if any specific circumstances exist and you would like our suggestions.

The most important thing to remember is that unless you are converting a very small office, most cutovers will take more than one day to complete. To keep your PressureMAP office running and collecting data during the cutover process, cut over devices in the CO (air dryers, etc.) first. Monitoring the central office devices will keep you in touch with the condition of the air pressure system during the cutover process. Also, after each board is cut to the 289H, remember to force a call to the 289H office so that PressureMAP will acquire readings for the devices on it.

1. Pull a current status report from the monitor that is going to be replaced and verify that: a) all devices have been input into PressureMAP, and b) each device has a valid input (device) number. Now is the time to correct any data deficiencies.

   For Sparton cutovers, it is recommended to have PressureMAP call the Sparton monitor before starting the conversion so that PressureMAP device data is updated with the most current *Mod* and *Input#* information from the Sparton device record. Please note that a call to the Sparton 5300B or 5318 will update both the module and input number. For the 5301A, the *Mod* information is not available, so only the *Input#* is updated. Module information must be updated manually.

2. Next back up the MAP System files. Depending upon which Version of PressureMAP you are using, system backups can be performed from the System Administration Menu using a traditional backup tape cartridge or one of the methods available with the BackupEDGE utility provided as a third-party application for PressureMAP. The backup medium will

enable you to restore the office to its original configuration if the office data is lost during the conversion process. If this situation occurs, just run the restore option of System Administration.

3. Install the 289H and connect the working phone line or network connection to it. If the permanent telephone line is unavailable or has not yet been assigned, a temporary one can be used. Refer to Section 3 in this manual for installation instructions.

   For a 289H LSS using a LAN Controller Card, make sure that the necessary LAN IP Address, Port Number, Gateway and Subnet designations have been assigned. You will need to complete the LAN process described in the previous chapter.

4. Through PressureMAP Data Entry, create a new office and enter the correct monitor type and phone number/IP address for the 289H in the Office Information Screen, but disable the office from calling.

5. Call the new 289H office using the CPAMS Diagnostics option of the MAP Programs Menu. After connecting with the 289H, perform Test 1, System Configuration, to verify that all subscriber and dedicated boards are working and are in the proper order.

   For example, In Sparton conversions that utilize Sparton Dedicated Replacement Card (SPDR) relay cards, the SPDRs must be placed in the chassis in front of other relay card types, and they must be ordered (configured) as A, B, C, A, B, C, etc. Instructions for configuring the cards are provided in Section 4.

6. Now is the time to turn on User Defined Devices in the 289H office if you want the device numbers to remain the same. Use PressureMAP Data Entry to access the office information screen. Also enter the Alert phone number/IP address, if known, and the Alert baudrate.

7. The next step is to select the Data Entry option, Special Data Entry, and run an Office and Device Information Conversion for the new 289H office. This function can be accessed from Special Data Entry, Option 1, 289 LSS CPAMS Conversion. After the conversion program has called the 289H monitor for the card configuration, print out a Post-Conversion Worksheet. Refer to the Special Data Entry section of the *PressureMAP System Data Entry Manual* for complete details on how to access this program, and also for information on the 289H access numbers.

8. If you need to manually edit devices to match the order of the planned wiring setup, refer to the Special Data Entry section titled “Using the Data Conversion Spreadsheet” for editing instructions.

9. When you are ready to start the physical cutover process, follow the procedures in Section 4 of this manual (Connector Block Wiring section). Use the Post-Conversion Worksheet you printed in step 7 as a wiring guide. After each board is cut to the 289H, remember to force a call to the 289H office so that PressureMAP will acquire current readings for the devices associated with the card.

   To maintain constant office monitoring, air dryers should be cut over first. When cutting over air dryers, it is a good idea to create a short on the pair monitoring the dryer to verify the correct alarm state. Also, the non-alarm state (OPEN, CLSD, or BOPN), will need to be entered into the PressureMAP Norm data field for the device.

10. Each 289H device has an extra device data field called TD Type. The possible TD types are listed in the tables on the pages that follow. As the PressureMAP default for the device may not reflect how it is actually wired in the field, it is important that you compare the new 289H reading of the device with the last reading from the old monitor. If it is reading UBAL, OPEN, SHRT, or is vastly different from its former reading, you will need to edit this field.

    Performing CPAMS Diagnostics (as described in Appendix 6 of this manual), can assist in determining the actual wiring of each device. For some Device Types, the PressureMAP editor automatically fills in the required TD Type, and will not allow you to edit that field. Please note that 289H monitors are not configured to read volume counters, so PressureMAP will post an EDIT reading for these devices. Any existing volume counters in the office need to be replaced with flow transducers.

11. When all of the devices are cut over to the 289H, enable the office. PressureMAP will now begin to collect readings for the new 289H office at regularly scheduled intervals.

While these basic steps can be followed for most cutovers, remember that they may need to be modified and customized to fit your particular needs.

PressureMAP Device Types

Pressure Transducers

AP Aerial Cable PTD
BP Buried Cable PTD
CP Compressor/Dryer PTD
DP Distribution Panel PTD
EP Pipe Endpoint PTD
FP Flow Bank PTD
GP Aerial Single Feed PTD
HP Buried Single Feed PTD
JP Underground Single Feed PTD
MP Manifold PTD (associated w/ a pipe)
PP Pipe Midpoint PTD
QP Priority Aerial Cable PTD
RP Remote Dryer PTD
SP Source (Pipe Panel) PTD
TP Trunk/Toll Cable PTD
UP Underground Cable PTD
WP Deep Underground Cable PTD
$P High Priority PTD

Flow Transducers

DF Distribution Panel FTD (not associated w/ a pipe)
IF Cable FTD
LF Lateral FTD
MF Manifold or other FTD (associated w/ a pipe)
QF Single Feed Cable FTD
RF Remote Dryer FTD (not associated w/ a pipe)
SF Source (Pipe Panel) FTD
$F High Priority FTD

Contactors

AC Aerial Cable Pressure Contactor
BC Buried Cable Pressure Contactor
CC Compressor/Dryer Pressure Contactor
DC Distribution Panel Pressure Contactor
EC Pipe Endpoint Pressure Contactor
PC Pipe Midpoint Pressure Contactor
RC Remote Compressor/Dryer Pressure Contactor
SC Source Pressure Contactor
TC Trunk/Toll Pressure Contactor
UC Underground Cable Pressure Contactor
WC Deep Underground Cable Pressure
XC Cable Theft Monitoring Contactor
$C High Priority Pressure Contactor

Contact Alarms

CA Compressor/Dryer Contact Alarm
DA Distribution Panel Contact Alarm
KA Alternating Compressor Contact Alarm
PA Sparton 270/540K ohm Converter Contact Alarm
RA Remote Dryer/Compressor Contact Alarm
SA Source Pipe Panel Contact Alarm
$A High Priority Contact Alarm
YA Configurable "Minor" Contact Alarm
ZA Configurable "Major" Contact Alarm

Volume Counters (not 289H/uM260-compatible)

DV Distribution Panel Volume Counter (not associated with a pipe)
MV Manifold or Distribution Panel Volume Counter
RV Remote Compressor/Dryer Volume Counter
SV Source Volume Counter
$V High Priority Volume Counter

Special Use Device Types

AB Barometric Pressure Transducer
AT Aerial Cable Temperature Transducer (289H)
AV AC Voltage Transducer, 115VAC (289H)
BI Bi-Directional Flow Transducer
BV AC Voltage Transducer, 230VAC (289H)
CV 3-Phase AC Voltage Transducer (289H)
CW Chilled Water Temperature Transducer (289H)
FT Fahrenheit Temperature Transducer (Dial-a-Ducer)
JD Air Temperature Sensor in Relative Humidity/Temperature Transducer (289H/uM260)
LB Air Tank Pressure Transducer - Metric (289H)
MB Air Tank Volume TD, % Remaining (289H/uM260)
NB Air Tank Volume Transducer (289H)
RG Wire Pair Monitor - Ring/Gnd (289H)
RH Relative Humidity Sensor (289H/uM260)
RS Wire Pair Monitor - Tip/Ring (289H)
RT Wire Pair Monitor - Tip/Gnd (289H)
TE Air Temperature Sensor (289H)
VD DC Voltage Output Measurement (289H) (TMACS)
VE Variable Location Electric Transducer
VO AC Voltage Output Measurement (289H)
VT Variable Location Temperature Transducer (TMACS)
WA Water Level TD - Addressable (289H)
WL Water Level TD (289H)
WW Warm Water Temperature TD (289H)
XL Utility Hole Water Level TD (289H)
$T High Priority Temperature Transducer

Table 6-1: PressureMAP Device Types

289H Resistive Transducer Types

Pressure—PSI	
RP	Standard Resistive Pressure Transducer: 0–9.5 PSI
RP/HP-PSI	High Pressure Resistive Transducer: 5–14.5 PSI
RP/RG-PSI	Resistive Pressure Transducer using ring with sheath as ground
RP/RG/HP-PSI	High Pressure Resistive Transducer using ring with sheath as ground
RP/TG-PSI	Resistive Pressure Transducer using tip with sheath as ground
RP/TG/HP-PSI	High Pressure Resistive Transducer using tip with sheath as ground
Pressure—KPA	
RP-KPA	Standard Resistive KPA Pressure Transducer: 0–65.5 KPA
RP/HP-KPA	High Pressure Resistive KPA Transducer: 34.48–99.98 KPA
RP/RG-KPA	Resistive KPA Pressure Transducer using ring with sheath as ground
RP/RG/HP-KPA	High Pressure Resistive KPA Transducer using ring with sheath as ground
RP/TG-KPA	Resistive KPA Pressure Transducer using tip with sheath as ground
RP/TG/HP-KPA	High Pressure Resistive KPA Transducer using tip with sheath as ground
Flow—SCFH	
RF/(range)	Standard Resistive Flow Transducer–9 ranges of SCFH: 0–9.5, 0–19.0, 0–20.0, 0–47.5, 0–50.0, 0–95.0, 0–100.0, 0–190.0, 0–200.0
RF/RG/(range)	Resistive Flow Transducer using ring with sheath as ground–9 ranges of SCFH: 0–9.5, 0–19.0, 0–20.0, 0–47.5, 0–50.0, 0–95.0, 0–100.0, 0–190.0, 0–200.0
RF/TG/(range)	Resistive Flow Transducer using tip with sheath as ground–9 ranges of SCFH: 0–9.5, 0–19.0, 0–20.0, 0–47.5, 0–50.0, 0–95.0, 0–100.0, 0–190.0, 0–200.0
Flow—LPH	
RF/(range)	Resistive Flow Transducer–9 ranges of LPH: 0–270, 0–540, 0–570, 0–1350, 0–1420, 0–2700, 0–2830, 0–5380, 0–5670,
RF/RG/(range)	Resistive Flow Transducer using ring with sheath as ground–9 ranges of LPH: 0–270, 0–540, 0–570, 0–1350, 0–1420, 0–2700, 0–2830, 0–5380, 0–5670
RF/TG/(range)	Resistive Flow Transducer using tip with sheath as ground–9 ranges of LPH: 0–270, 0–540, 0–570, 0–1350, 0–1420, 0–2700, 0–2830, 0–5380, 0–5670
Contact Alarm	
CPAMS_TD	Standard Resistive Contact Alarm
CPAMS_TD/RG	Resistive Contact Alarm using ring with sheath as ground
CPAMS_TD/TG	Resistive Contact Alarm using tip with sheath as ground
AC/115	Contact Alarm for 115V: 540K resistance OK, 270K resistance is ALRM
DRYER	Contact Alarm for 115V: 540K resistance OK, 270K resistance is ALRM (same as AC/115 Transducer Type)
AC/230	Contact Alarm for 230V; 540K resistance OK, 270K resistance is ALRM
RR/540K	Contact Alarm; 540K resistance OK, SHRT is ALRM
Other Device Applications	
RG/100M	Resistive open pair, monitors the resistance of a pair (Ring/Gnd)
RR/100M	Resistive open pair, monitors the resistance of a pair (Tip/Ring)
RT/100M	Resistive open pair, monitors the resistance of a pair (Tip/Gnd)
TEMP/212	Thermistor Water Temperature Transducer; range -40 to +212^{o} F
TEMP/212/H	Thermistor Air Temperature Transducer; range 32 to 212^{o} F

TABLE 6-2: 289H RESISTIVE TRANSDUCER TYPES

289 and 289H Current Loop Transducer Types

Pressure—PSI	
CPA/15.0	Current Loop Pressure Transducer, 0–15.0 PSI (absolute)
CPA/30.0	Current Loop Pressure Transducer, 0–30.0 PSI (absolute)
CPA/RG/(range)	Current Loop Pressure Transducer using ring with sheath as ground, 2 ranges: 0–15.0 PSI and 0–30.0 PSI
Pressure—KPA	
CPA/100.0	Current Loop Pressure Transducer, 0–100.0 KPA (absolute)
CPA/200.0	Current Loop Pressure Transducer, 0–200.0 KPA (absolute)
CPA/RG/(range)	Current Loop Pressure Transducer using ring with sheath as ground, 2 ranges: 0–100.0 KPA and 0–200.0 KPA
Flow—SCFH	
CF/9.5	Current Loop Flow Transducer, 0–9.5 SCFH
CF/19.0	Current Loop Flow Transducer, 0–19.0 SCFH
CF/47.5	Current Loop Flow Transducer, 0–47.5 SCFH
CF/95.0	Current Loop Flow Transducer, 0–95.0 SCFH
CF/190	Current Loop Flow Transducer, 0–190 SCFH
CF/475.0	Current Loop Flow Transducer, 0–475.0 SCFH
CF/950.0	Current Loop Flow Transducer, 0–950.0 SCFH
CF/RG/(range)	Current Loop Flow Transducer using ring with sheath as ground, 7 ranges: 0–9.5 SCFH, 0–19.0 SCFH, 0–47.5 SCFH, 0–95.0 SCFH, 0–190.0 SCFH, 0–475.0 SCFH, 0–950.0 SCFH
Flow—LPH	
CF/270	Current Loop Flow Transducer, 0–270 LPH
CF/540	Current Loop Flow Transducer, 0–540 LPH
CF/1350	Current Loop Flow Transducer, 0–1350 LPH
CF/2700	Current Loop Flow Transducer, 0–2700 LPH
CF/13500	Current Loop Flow Transducer, 0–13500 LPH
CF/27000	Current Loop Flow Transducer, 0–27000 LPH
CF/RG/(range)	Current Loop Flow Transducer using ring with sheath as ground, 6 ranges: 0–270 KPA, 0–540 KPA, 0–2700 KPA, 0–5345 KPA, 0–13500 KPA, 0–27000 KPA
Other Device Applications	
BARO/35	Barometric Pressure Transducer, range 20.6–91.1 inches of Hg
BARO/RG/35	Barometric Pressure Transducer using ring with sheath as ground, range: 20.6–91.1 inches of Hg
BARO/1200	Barometric Pressure Transducer, range: 750–1200 millibars
BARO/RG/1200	Barometric Pressure Transducer using ring with sheath as ground, range: 750–1200 millibars
BFTD/475.0	Barometric Pressure Transducer, range 20.6-91.1 inches of HG
CL/THEFT	Current Loop Contact Alarm, used for cable theft detection (multiple devices on a pair)
EURO_TANK	Tank Pressure Transducer (metric), 0–204 bars
RH/100	Relative Humidity Transducer, range: 0%–100% RH
TANK	Tank Volume Transducer, 0–200 cubic ft
TANK_PCT	Tank Volume Transducer, indicates percentage remaining
TEMP/167	Temperature Transducer, range: 0–167^{o} F
TEMP/RG/167	Temperature Transducer using ring with sheath as ground, range: 0–167^{o} F
TEMP/75	Temperature Transducer, range: 0–75^{o} C
TEMP/RG/75	Temperature Transducer using ring with sheath as ground, range: 0–75^{o} C
WATER/20	Water Level Transducer, range: 0–20.8 inches
WATER/30	Water Level Transducer, range: 0–30 feet

TABLE 6-3: 289H CURRENT LOOP TRANSDUCER TYPES

UNDERSTANDING HOW CONTACTORS WORK WITH PRESSUREMAP AND THE 289H LSS

When the original 289 Loop Surveillance System was released, there was some confusion about how status contactors work. The purpose of this document is to describe how contactors can be used, how they are wired, and how to set them up in PressureMAP.

Contactors are useful for monitoring equipment where only two readings are needed; in PressureMAP these readings are OK and ALRM. Since contactors are used to monitor equipment that is crucial to the air pressure system, such as air dryers, it is important that loss of "continuity" in the contactor loop is monitored. In other words, the monitoring system needs to watch for the pair going "open" and the contactor not being able to provide a reading. Without these vital functions, the state of the dryer cannot be indicated.

Contactor Wiring and PressureMAP

FIGURE 6-1 shows the typical way a status contactor is wired. The basic loop consists of a pair of wires terminated by a resistor. The contact switch, with a serial resistor, goes across the pair. When the contact is "open", only the resistor at the end of the pair (the terminating resistor) is readable by either a meter or the 289H LSS. In the "closed" position, both resistors are across the pair and can be read.

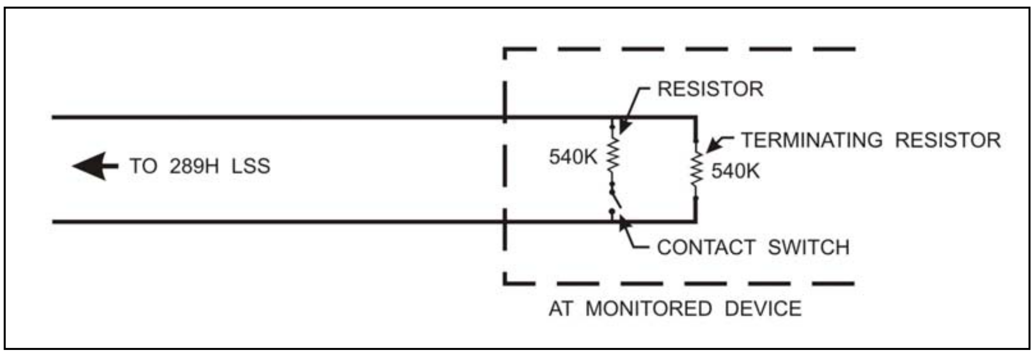


FIGURE 6-1: TYPICAL CONTACT WIRING

The terminating resistor usually reads 540,000 (540K) ohms. When the contact switch is open, the contactor will read about 540K ohms across the pair; when it is closed, the reading will be about 270K ohms.

FIGURE 6-2 shows another way a status contactor can be wired. When the switch is open, the value of the two resistors is added together, and the contactor will read about 540K ohms. When the switch is closed, only one resistor is in the loop, and the reading will be about 270K ohms.

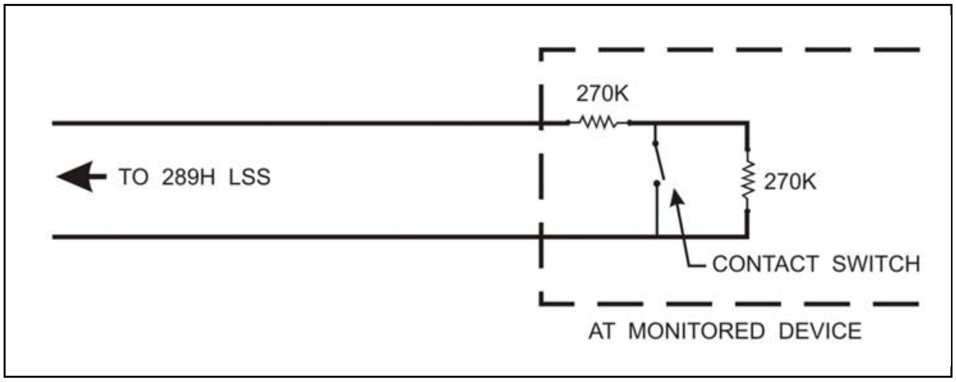


FIGURE 6-2: ANOTHER CONTACT WIRING EXAMPLE

When the dryer (or other piece of equipment) is operating normally, the contact switch can be either open or closed. It will change to the opposite state during an alarm condition. For this reason, PressureMAP needs to know when the contactor should read OK and when it should read ALRM.

Entering OPEN or CLSD in the NORM field of the editor's device screen will tell PressureMAP how to read the contactor. OPEN means the contact switch is normally open (resistance is 540K ohms) and everything is OK. The resistance will read 270K ohms when the switch is closed, and this will generate a reading of ALRM. Entering CLSD in the NORM field means that the contact switch is normally closed, and a resistance reading of 270K ohms would generate a PressureMAP reading of OK. A resistance reading of 540K ohms would generate a reading of ALRM.

FIGURE 6-3 shows a “resistance line” indicating what this contactor will read depending on the resistance measured across the pair, based on the entry in the NORM field of the device screen. Because of changes in temperature, inaccuracies in resistors, and loop resistance (the resistance of the wires), there is a tolerance or “band” around 270K ohms and 540K ohms where the reading will remain ALRM or OK.

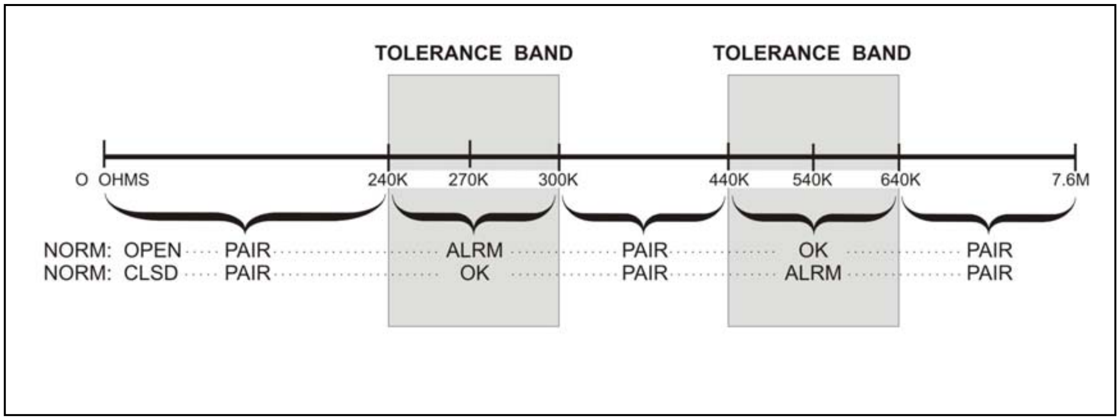


FIGURE 6-3: PAIR RESISTANCE READINGS FOR STATUS CONTACTORS

When the resistance is not close to either 270K ohms or 540K ohms, the device will give the error reading, PAIR, indicating pair trouble. This reading, along with ALRM, will generate a four star alarm in PressureMAP since both pair trouble and bad resistance readings create alarms. It also ensures that the dryer is always monitored.

Binary Contactors

There is another "flavor" of status contactor called the binary contactor, shown in FIGURE 6-4. Note that it is simply a contact switch across a pair of wires. When the contact is open, the circuit will read infinite resistance (actually, PressureMAP can read up to 7.6M ohms of resistance and the 289H can read up to 50M ohms). When the contact is closed, it will almost read as a short (the measured loop resistance is usually less the 1,000 ohms).

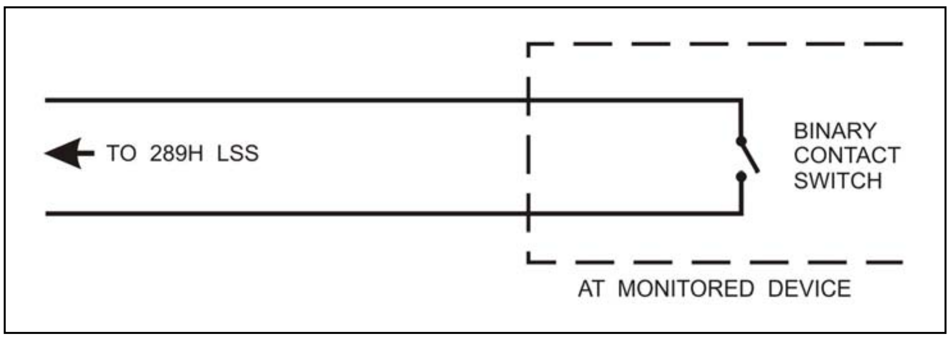


FIGURE 6-4: BINARY CONTACT WIRING

Like the contactors described earlier, the binary contact switch can be either open or closed and still be reading normally. PressureMAP decides which state the device is in by seeing if the reading is above or below 100K ohms. If it is above 100K ohms, the switch is open. If it is below 100K ohms, the switch is closed.

To tell PressureMAP which state is OK, BOPN (Binary Open) or BCLS (Binary Closed) is entered in the NORM field of the Specific Device Information Screen for the device. Entering BOPN will mean that if the contactor resistance is above 100K ohms, the device is OK. If the resistance reading is below 100K ohms, the reading is ALRM. Entering BCLS would mean just the opposite. Resistance below 100K ohms would read OK and resistance above 100K would read ALRM. Like the other contactor, an ALRM reading would generate a four star alarm.

Generally, System Studies does not recommend using binary contactors because they cannot pick up pair trouble. FIGURE 6-5 shows the resistance line for a binary contactor. If the device has BOPN in the Norm field and the pair goes open, the resistance will be 7.6M ohms and the reading will be OK, even though it should generate a four star alarm. This is not a limitation of the 289H LSS or PressureMAP, but a result of the way in which the contactor is wired.

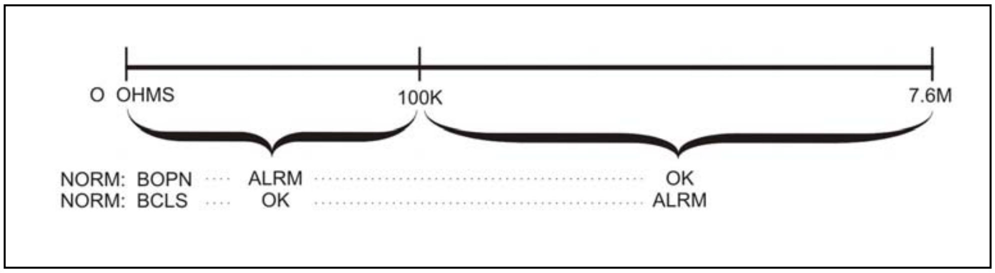


FIGURE 6-5: PAIR RESISTANCE READINGS FOR BINARY CONTACTORS

Additional PressureMAP Contactor Readings

There are several other values that a status contactor can read: BUSY, VOLT and NSE. BUSY applies to a contactor that is wired onto a subscriber pair. This reading indicates that the subscriber is using the line and the 289H LSS cannot obtain a reading. This condition is considered temporary because the subscriber will eventually hang up. Therefore, it does not generate a dispatch.

VOLT indicates that there is external DC voltage applied to the pair (usually ring leakage). The voltage may originate either inside or outside the central office. This reading generates a four star dispatch.

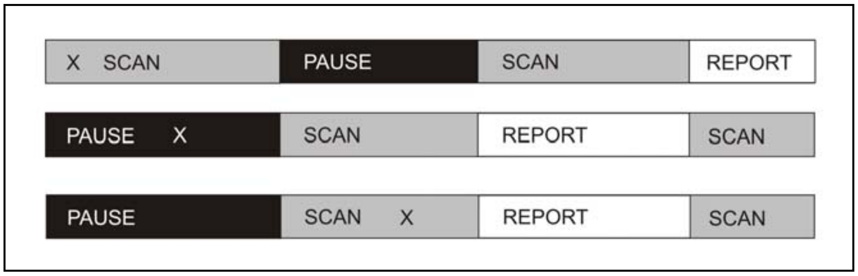
NSE (Noise) indicates that the reading did not settle within .5 seconds, either due to excess AC voltage or some instability related to the pair such as a bad contact or connection. The AC voltage usually comes from outside the central office. The NSE reading also generates a four star dispatch.

As you can see, the status contactor is an important component of PressureMAP and the monitoring of equipment crucial to the air pressure system. I hope that this information has been helpful in clearing up some of the confusion you may have had when hooking up status contactors to a 289H LSS. If you have any further questions, please call System Studies' Technical Support Department at (800) 247-8255 or (831) 475-5777.

289H LSS SCAN AND ALERT CYCLES

The 289H LSS repeatedly scans each of the monitoring devices that have been electrically connected to its dedicated and/or subscriber relay boards. During each scan cycle, the 289H compares the scanned reading with a predetermined threshold. If the reading exceeds the alert threshold criteria, a flag is set and the 289H continues its scan. After each of the monitoring points has been scanned, the 289H reports any alert conditions encountered in the scan cycle to the PressureMAP software for analysis and possible dispatching. The 289H will pause for five minutes and then start another scan cycle. Each point in a scan takes from 300 to 600 milliseconds (msec) to read, depending on the type of reading and the settling times involved.

To examine how long it will take to receive an alert from the 289H, we have provided three possible scenarios representing when (in relation to the scan cycle) the device (point) comes into alert. The "X" in the diagrams below indicate the onset of an alert condition. The best case would be the point coming into alert just prior to being scanned, as shown in the top scenario of EXAMPLE 6-1. An intermediate case would be a point coming into alert during the pause period (second scenario). The worst case, of course, would be a point coming into alert just after it was scanned.



EXAMPLE 6-1: 289H SCAN SCENARIOS

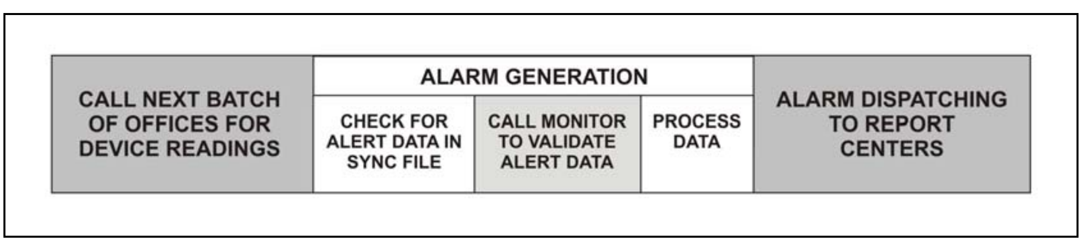
Let us consider a 100 point system and assume the worst case timing of 600 msec/point and a five minute pause. In our best case scenario, the alert would be reported from 1 to 60 seconds from the time of its occurrence. In the intermediate case the alert would be reported from 1 to 6 minutes from its occurrence. The worst case occurrence would take 5 to 6 minutes to be reported. You can use the following formulas to determine the best and worst case report times.

Best Case Time = (Number of Points) x (0.6 Seconds)
Worst Case Time = [(Number of Points) x (0.6 Seconds) / 60] + (5 Minutes)

When alert data is received by the MAP System, it is saved to the database and processed by the alarm generator and delivery system. The alarm generator software calls the monitor to validate the alert, taking a realtime reading of the device and the associated devices on either side. These readings are compared to the current information in the database to determine if the alert data is valid. This automatic validation process, which replaces the normal manual call by a technician to verify an alarm condition, and the dispatching of a valid alarm to the first designated Alarm Center, is generally completed within a 20 minute time frame, depending upon where the MAP System is in its list of routine, scheduled events.

If the associated data record for the device is locked by another MAP process, such as a user-initiated realtime reading or office data entry, the alert is saved in the alarm synchronization data file. It is processed when the data record becomes available.

EXAMPLE 6-2 illustrates the schedule of routine events for PressureMAP systems running software Version 17 and above. These scheduled functions take approximately 20 minutes to complete, with calls to each batch of offices cycling throughout the day. If the call time of a particular PressureMAP system takes much longer than 20 minutes, additional modems may need to be added to increase overall system efficiency.



EXAMPLE 6-2: PRESSUREMAP ROUTINE EVENTS

When the MAP System consists of only 289H LSS offices, the automatic validation function of the alarm generator can be turned off. The unique data transmission method of the 289H LSS allows for great accuracy in data transmission, eliminating the need for an addition call to the monitor to verify the data received. With alarm validation turned off, the throughput time for alarm generating is reduced, and the alarm is dispatched as soon as Alarm Dispatching becomes the current event of the MAP System's schedule.