Appendix 3

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.

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 A3-1 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.

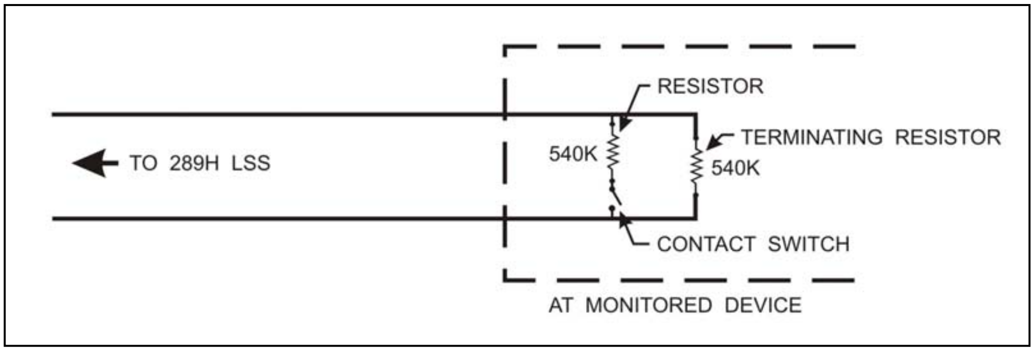


FIGURE A3-1: TYPICAL CONTACT WIRING

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 A3-2 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.

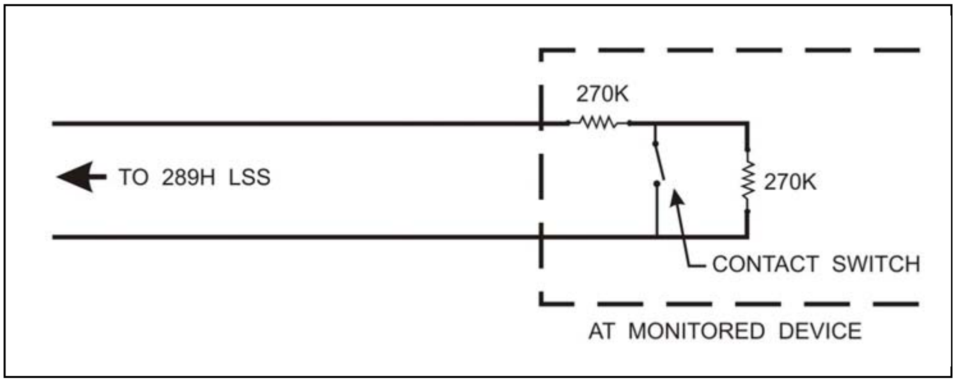


FIGURE A3-2: ANOTHER CONTACT WIRING EXAMPLE

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 A3-3 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.

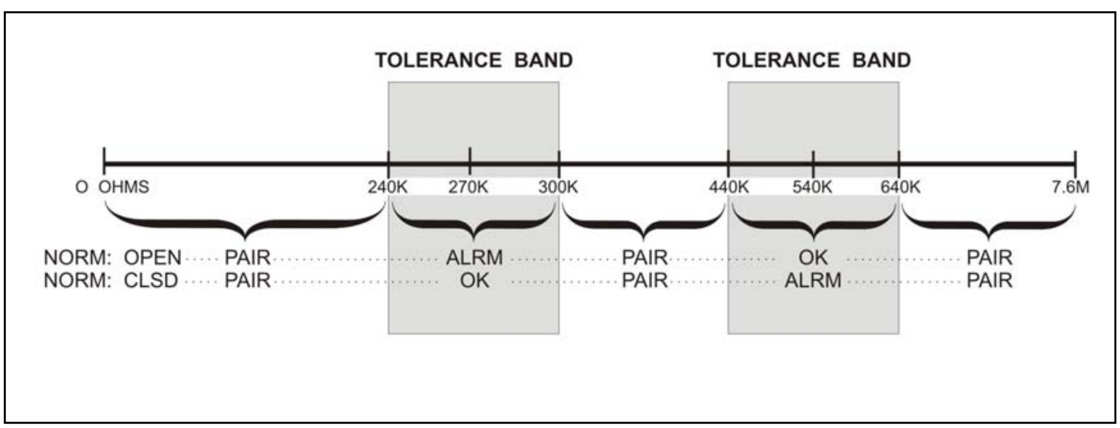
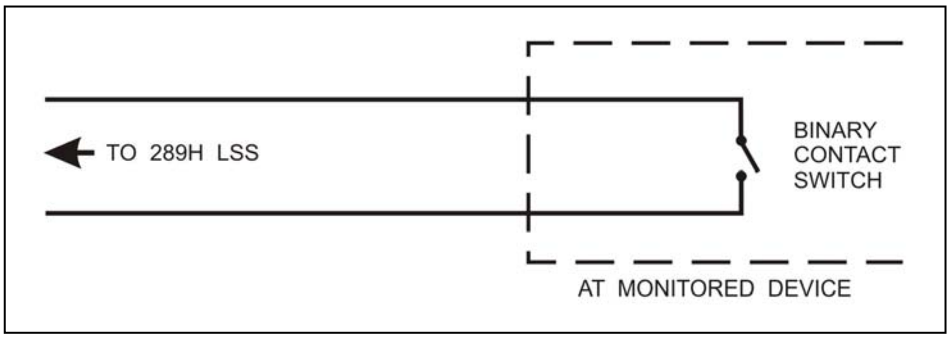


FIGURE A3-3: PAIR RESISTANCE READINGS FOR STATUS CONTACTORS

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 A3-4. 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).



FIGUREA3-4: 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.

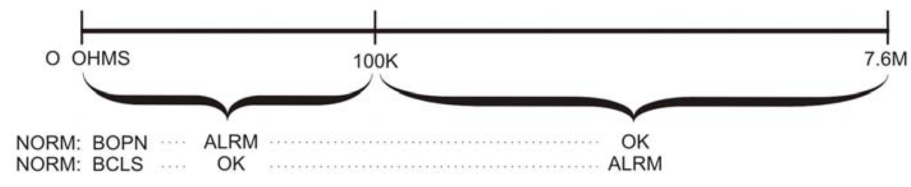


FIGURE A3-5: PAIR RESISTANCE READINGS FOR BINARY CONTACTORS

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.

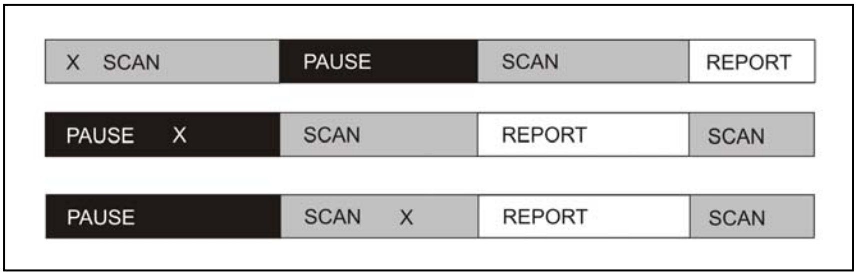
NSE (Noise) indicates that the reading did not settle within .5 seconds, either due to excess AC voltage or some instability related to the pair such as a bad contact or connection. The AC voltage usually comes from outside the central office. The NSE reading also generates a four star dispatch.

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 A3-1. 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 A3-1: 289H SCAN SCENARIOS

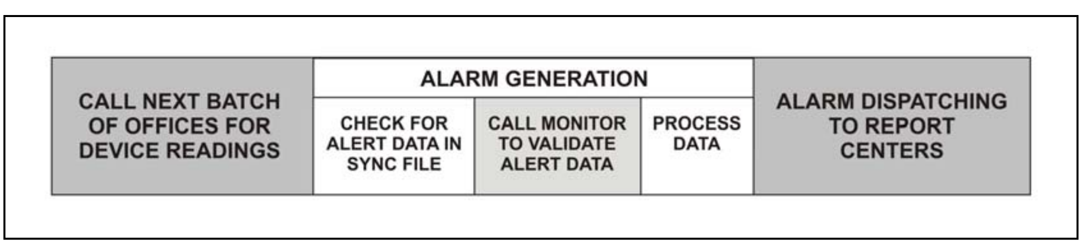
Let us consider a 100 point system and assume the worst case timing of 600 msec/point and a five minute pause. In our best case scenario, the alert would be reported from 1 to 60 seconds from the time of its occurrence. In the intermediate case the alert would be reported from 1 to 6 minutes from its 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 A3-2 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 A3-2: 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.