SINCE 1948
RACO
REMOTE ALARMS AND CONTROLS

RACO Manufacturing and Engineering Co., 1400 62nd St., Emeryville, CA 94608 (510) 658-6713 800-722-6999 FAX (510) 658-3153

WIRING AND PROGRAMMING FOR THE VERBATIM ANALOG OPTION

ANALOG CONNECTIONS:

- Refer to the separate diagram showing the VAN analog boards for connection of analog inputs.
- Be sure you follow the indicated positive and negative polarity indications, except in the case of TS705 temperature sensor inputs, for which positive and negative polarity does not matter.
- Note that two signal wires are required for each input.
- Note that the terminal blocks are unpluggable for convenience.
- Because of the space constraints, it is best to use small gauge wire like telephone wire. If bulkier wire is needed outside the dialer, it is best to install a terminal strip outside the dialer to make the transition from the bulkier wire to the more compact wiring going into the analog input connection points.
- Take care to route the incoming signal wires to one side of the enclosure or the other so that they do not interfere with the front panel circuit board when the unit's door is closed. Also, try to route the analog signal wires away from power wiring to minimize noise pickup.

PROGRAMMING FOR ANALOG CHANNELS:

Each analog input will need to be programmed to specify:

- The analog Input Signal Type (if other than standard 4-20 ma input) .
  (Code 5 ZZ 7 N)
- The numerical value to be spoken at a corresponding minimum signal level .
  (Code 5 ZZ 2 xx.x)
- The numerical value to be spoken a corresponding maximum signal level.
  (Code 5 ZZ 4 xx.x)
- In many cases you will also want to program high and low set point limits for each analog input.
  (Codes 5 ZZ 5 xx.x and 5 ZZ 6 xx.x)
- You may also elect to replace the generic default voice message with your own recorded messages for any analog channel.
  (Codes 1 ZZ and 2 ZZ)

ASSIGNMENT OF INPUT CHANNEL NUMBERS:

The unit automatically assigns the lowest channel numbers to whatever number of contact input channels exist on the unit (whether or not you are using them); and the analog channels are assigned channel numbers beginning with the next available number. For example, the first analog input on a unit with 24 contact inputs and 16 analog inputs would be "channel 25" and the last analog input would be "channel 40".

- Note that since the unit's maximum LED display capacity is a total of 32 channels, on such a unit the final 8 analog channels would not have corresponding LED status indicators on the front panel. It is important that you have correctly determined the channel number assigned for each analog input channel before performing the following programming steps.
- The alert reader may notice that the programming codes described below can duplicate some programming codes which are designated for other functions for contact (non-analog) input.
- The unit knows that a given input channel is an analog channel, and acts on code entries accordingly, allowing the same codes to be used for different functions on the two different kinds of input.

PROGRAMMING THE INPUT SIGNAL TYPE:

- You may skip this step if you are using 4-20 ma inputs.
- The analog inputs are very flexible and can accommodate a variety of Input Signal Types, but the unit needs to know which type each input is being used for a given analog input.
- Note that in addition to programming the Input Signal Type, the physical component configurations on the VAN plug-in circuit card must match the Signal Type used. Normally this will have been handled in the process of ordering the unit and will not require additional user attention. If there is any doubt about this, refer to the markings on the rear of the VAN circuit board.
- If there is still any question, refer to the markings you find and also your unit's serial number, when contacting the factory.

TO PROGRAM THE INPUT SIGNAL TYPE FOR CHANNEL ZZ:

- 5 ZZ 7 N ENTER where ZZ is the two-digit channel number, and N is a single digit as follows:
- 0 is for a 4-to-20 milliamp current loop input. This is the default setting, so if your inputs are 4-20 milliamp current loops, you may skip this step.
- 1 is for 0 to 1 volt DC signal input. In the case of larger signal levels, such as 0 to 10 volts DC, the hardware input circuitry on the VAN card will have been factory configured to pre-scale the signal to a range within 0 to 1 volt DC, and corresponding special scaling information will be provided to fit the particular application.
- 2 is for a Raco Temperature Sensor input (sensor model TS705A), used to measure temperatures from -20 to +120 degrees F.
- 3 is for additional types of special custom-specified signals.

Summary of codes for Input Signal Type:

0 (default) 4-20 ma current loop
1 0-1 volt DC
2 Raco temperature sensor
3 Other special inputs

PROGRAMMING THE SCALING & OFFSET FACTORS:

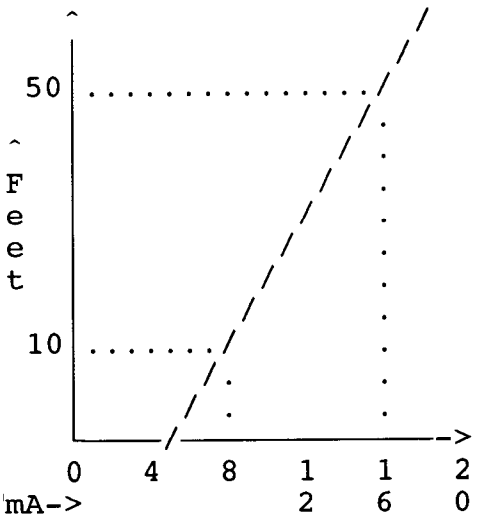
(This set of steps is not necessary for inputs using a Raco Temperature Sensor, since these values will be automatically inserted if the parameter 2 is selected in the above step.)

In the above step, accepting the default parameter of 0 for 4-20 milliamp inputs automatically provides for a spoken reading of 0.0 percent for the minimum (4 ma) signal input value, and 100.0 percent for the maximum (20 ma) signal, until you enter different factors. In most cases, you will want to program the unit to give spoken reports in terms of the actual physical variables being monitored, such as water level in feet, etc.

In general, you will need to determine the desired spoken numerical values corresponding to two widely separated (low end and high end) signal input values. Often this will be available from the overall system specifications. In other cases, this will be determined (or revised) based on actual on-the-spot observations.

The VERBATIM autodialer offers the unique option of entering this scaling information based either on your particular system specifications (the SYSTEM SPECIFICATIONS METHOD) or else on your real world observations (the REAL WORLD METHOD). Also, scaling information which you may have originally entered based on your system specifications may later be easily “fine tuned” based on real world observations. In addition, you may wish to record your own identifying message to replace the default message.

ADDITIONAL PERSPECTIVE ON SCALING FACTORS:



It may be useful, in comprehending the process of establishing the scaling factors, to visualize a graph which relates the water level in a tank to the input from a 4-20 mA transducer. To establish the relationship on such a graph, it is necessary to define two separate points, or coordinate pairs ideally at two widely separated points on the graph. For such a linear relationship any point on the “reading” (y) may be calculated from the formula : $y = m x + b$ where m is the gain and b is the zero crossing point or Input (mA) offset. The gain may be calculated from:

$$m = (y2-y1)/(x2-x1)$$

where x1,y1 is one coordinate pair on the graph and x2,y2 is the other.

Therefore, when you have chosen to enter non-default coordinates you are in fact setting the gain factor. This gain factor is taken along with the input signal type you have chosen which will define both the gain and offset.

Notice that each of the two points requires two separate co-ordinate pieces of information to define: the signal level and the corresponding water level. With two such points defined, an entire line or linear equation is defined, so that given any new signal level, we could use the graph to “look up” the corresponding water level. In operation, the VERBATIM autodialer measures the signal level presented to it, and then “looks up” the corresponding physical value, all based on the line or linear equation defined by your entry of the high end and low end scaling information, whether done by the SYSTEM SPECIFICATIONS METHOD or by the REAL WORLD METHOD.

Be sure that the correct Input Signal Type setting is entered as described above, before doing the following programming steps, because changing the Signal Type setting will overwrite the programming described next.

“SYSTEM SPECIFICATIONS METHOD” OF PROGRAMMING SCALING FACTORS:

- For the low-end portion of the data for channel ZZ, enter the following pair of codes:

  5 ZZ 1 XXXX.XXXX ENTER where XXXX.XXXX is the low input signal value chosen; and

  5 ZZ 2 YYYY.YYYY ENTER where YYYY.YYYY is the desired spoken numerical value.

- Then to complete the scaling factors for this channel, enter the following pair of codes for the high-end portion of the data:

  5 ZZ 3 XXXX.XXXX ENTER or 5 ZZ 3 POINT ENTER

- for the high-end signal value, and

  5 ZZ 4 YYYY.YYYY for the high-end corresponding spoken value.

- Note that for all analog value entries you may enter up to four digits before an optional decimal point, and up to four digits after, but simpler entries (such as -20, 3.45, 500, 4, etc.) work as well.

ALTERNATIVE “REAL WORLD” METHOD OF PROGRAMMING SCALING FACTORS:

- If the system specifications for the scaling factors are not known, or if you wish to adjust a previous entry to reflect real-world as opposed to system-specification conditions, wait until the input signal or the physical variable happens to be near the low end of the scale.

- Enter the following pair of codes:

  5 ZZ 1 POINT ENTER

which will automatically accept the present moment signal value as the low input signal value, rather than having to enter the value shown as XXXX.XXX above.

- Then, enter:

  5 ZZ 2 YYYY.YYYY ENTER

where YYYY.YYYY is the corresponding low-end physical value which you observe in real-world terms.

- At another time, when the signal or physical variable is toward the high end of the scale, enter the following pair of codes:

  5 ZZ 3 POINT ENTER

which accepts the present signal level as corresponding to the high-end physical value which you enter as:

  5 ZZ 4 YYYY.YYYY ENTER

EXAMPLE: It may already be known from your system's specifications that for channel 6, a low-end signal of 4 milliamps corresponds to a desired spoken value of 20.5 feet of tank water level, and that the high-end signal level of 20 milliamps corresponds to a desired spoken value of 34.6 feet of tank water level. In such a case, you would use the SYSTEM SPECIFICATIONS METHOD to enter:

5 06 1 4 ENTER (for 4 milliamps)
5 06 2 20.5 ENTER (for a spoken reading of 20.5)
5 06 3 20 ENTER (for 20 milliamps)
5 06 4 34.6 ENTER. (for a spoken reading of 34.6)

Then, suppose with the system in operation, you observe that the tank level is 31.7 feet, but the VERBATIM reports a value of 31.45 feet. The discrepancy will most likely be due to a discrepancy of the sensor's actual output versus the theoretical system specifications. Regardless, to correct for it, keeping in mind that the signal is presently near the high end of the scale, you would use the REAL WORLD METHOD, entering:

5 06 3 POINT ENTER to reference the present signal level, and
5 06 4 31.7 ENTER to recalibrate 31.7 as the corresponding spoken value.

Continuing the example, there might also be a discrepancy toward the low end of the scale. Suppose on another day you observe a tank level of 22.5 feet but the VERBATIM reports 22.93 feet. Since this signal is at the low end of the range, you would enter:

5 06 1 POINT ENTER and
5 06 2 22.5 ENTER.

Notice that these REAL WORLD METHOD adjustments did not require you to measure any actual signal levels! From that time on, assuming that the sensor maintains its calibration and has a linear output, the spoken value should track the actual value very closely. The VERBATIM itself is much more accurate and consistent than almost any sensor available to connect to it. Note that the signal does not need to be exactly at the end of its range (e.g. 4 ma or 20 ma) for these programming steps.

However, in general the wider the spread between the signal levels used, the better informed the VERBATIM will be to reflect the actual relationship between the sensor's output and the real value being measured.

Notice also that while the unit reports to a very high accuracy and resolution, you do not need to enter your programming values to the same high degree of accuracy unless you choose to.

SPECIAL NOTE FOR TS705 TEMPERATURE SENSOR INPUTS:

Selecting signal type "2" (TS705 sensor) will automatically load scaling factors as described earlier. However these automatically loaded scaling factors are not adjustable. If you want to be able to do "real world" calibration adjustments for temperature sensor inputs, then instead of selecting sensor type "2", select sensor type "1" (0-1 VDC input) and enter scaling factors as follows:

5 ZZ 7 1 ENTER (to select signal type 1)
5 ZZ 1 .843 ENTER
5 ZZ 2 -19.8 ENTER
5 ZZ 3 .316 ENTER
5 ZZ 4 120.1 ENTER

This gives the same scaling factors as would otherwise automatically result from selecting signal type 2, but it allows for subsequent adjustments using the "real world" adjustment method.

PROGRAMMING HIGH AND LOW ANALOG SET POINTS:

- You should first enter the gain and offset factor programming described above before entering set points. Later, if you adjust the factors as described above, you may also need to adjust the set points correspondingly.

- To program a low limit set point for channel ZZ, use code:

  5 ZZ 5 XXXX.XXXX ENTER.

Note that XXXX.XXXX is the desired set point in terms of spoken units, rather than in terms of the signal value. You do not need to enter all four possible leading and trailing digits; simple entries like 7 and 3.68 work as well.

- To program a high limit set point for channel ZZ, use code:

  5 ZZ 6 XXXX.XXXX ENTER.

Thereafter, whenever the measured value exceeds the set point for a continuous period exceeding the alarm trip delay, the unit will go into unacknowledged alarm and begin dialing to report the specific violation, also reporting the current measured value. As with contact inputs, if the input is no longer in violation at the moment of the report, the phrase "NOW NORMAL" will be appended to that channel's report.

- To check an existing set point value, use the above codes but omit the values (XXXX.XXXX).
- To turn off (completely disable) an unused analog channel so that it will not be included in status reports, enter code:

  5 ZZ 0 ENTER where ZZ is the 2-digit channel number.

- To turn the channel on again, you must enter some high or low set point value for that channel.
- To turn off (disable) a high or low analog set point, while still leaving the channel able to report readings, enter a set point value of -0 for that particular set point. If you try to enter a set point value outside a valid signal range, the VERBATIM will say "Error in number".
- Note that the scanning time required by the unit in order to check all analog readings against established set points increases with the number of analog channels. With 16 channels, this time can total on the order of one second, and this imposes a limit on how fast the unit can detect analog set point violations. Normally this will not be noticed unless you set Alarm Trip Delays of less than two seconds, and there is no effect on the trip delay for contact channels in any case.
- Refer to the following section for recording the corresponding voice messages other than the spoken numerical values.

SUMMARY OF ANALOG PROGRAMMING CODES:

Signal Type:

5 ZZ 7	N	SELECT INPUT SIGNAL TYPE (0 is default, for 4-20 ma)

Scaling:

5 ZZ 1	XXXX.XXXX or POINT	LOW END SIGNAL VALUE
5 ZZ 2	YYYY.YYYY	CORRESPONDING LOW END SPOKEN VALUE
5 ZZ 3	XXXX.XXXX or POINT	HIGH END SIGNAL VALUE
5 ZZ 4	YYYY.YYYY	CORRESPONDING HIGH END SPOKEN VALUE

Set points:

5 ZZ 5	XXXX.XXXX	LOW ALARM LIMIT SET POINT
5 ZZ 6	XXXX.XXXX	HIGH ALARM LIMIT SET POINT
5 ZZ 5(6) -0		DISABLE LOW (HIGH) SET POINT

Eliminate channel:

5 ZZ 0	XXXX.XXXX	TURN OFF (ELIMINATE) CHANNEL ZZ

RECORDING SPEECH MESSAGES FOR ANALOG CHANNELS:

This information supplements the basic information in the manual on recording speech messages; refer to that information before attempting to record any speech messages.

- For analog input channels, the default message is “The present channel N reading is...“.
- For any analog inputs, in place of the default messages you may plan to record a preamble message of the general form “The total water flow in gallons is” or “the main tank water level in feet is”.
- Use program code 1 ZZ to record the analog preamble message.
- If you would prefer your message to be in the form
  “The main tank water level is (XXX) feet”
  then you may use a postamble message as well. Using a postamble message may use up more recording time than just a preamble.
- Use program code 2 ZZ to record the analog postamble message.

Example:
Channel 5 to report “The main tank water level is (xx.x) feet.”
Press 105, record “the main water tank level is.”
Press 205, record “feet.”

IMPORTANT NOTE: For analog channels, you only record the normal form of the message. Alarm messages (such as "high set point has been exceeded") will be added in the normal Verbatim voice.

NOTES:

- If analog inputs do not work correctly, recheck programming settings, especially the Input Signal Type setting.
- Verify that the polarity of your input connections is correct. In the case of a 4-20 ma input, does the spoken value always reflect a 0 ma signal level? If so, the problem is presumably with the connection or the signal source.

- Use a DC meter to verify that both sides of the offending input are within 10 VDC of ground. A 4-20 ma current loop input should give a meter reading of about .07 volt per milliamp of current as measured across the two signal input terminals. Are other instruments included in the same current loop? If they read correctly, temporarily disconnect the input to the autodialer. This should throw the readings of the instruments off scale. If there is no such effect, your wiring is not including the autodialer in the loop.
- Verify that the type of signal source agrees with the physical configuration on the VAN card according to the markings on the back of the card.
- If you have questions, call Raco Customer Support at 800-449-4539. The Customer Support Department will be available from 8:00am to 4:30pm PST, Monday through Friday (excluding holidays).