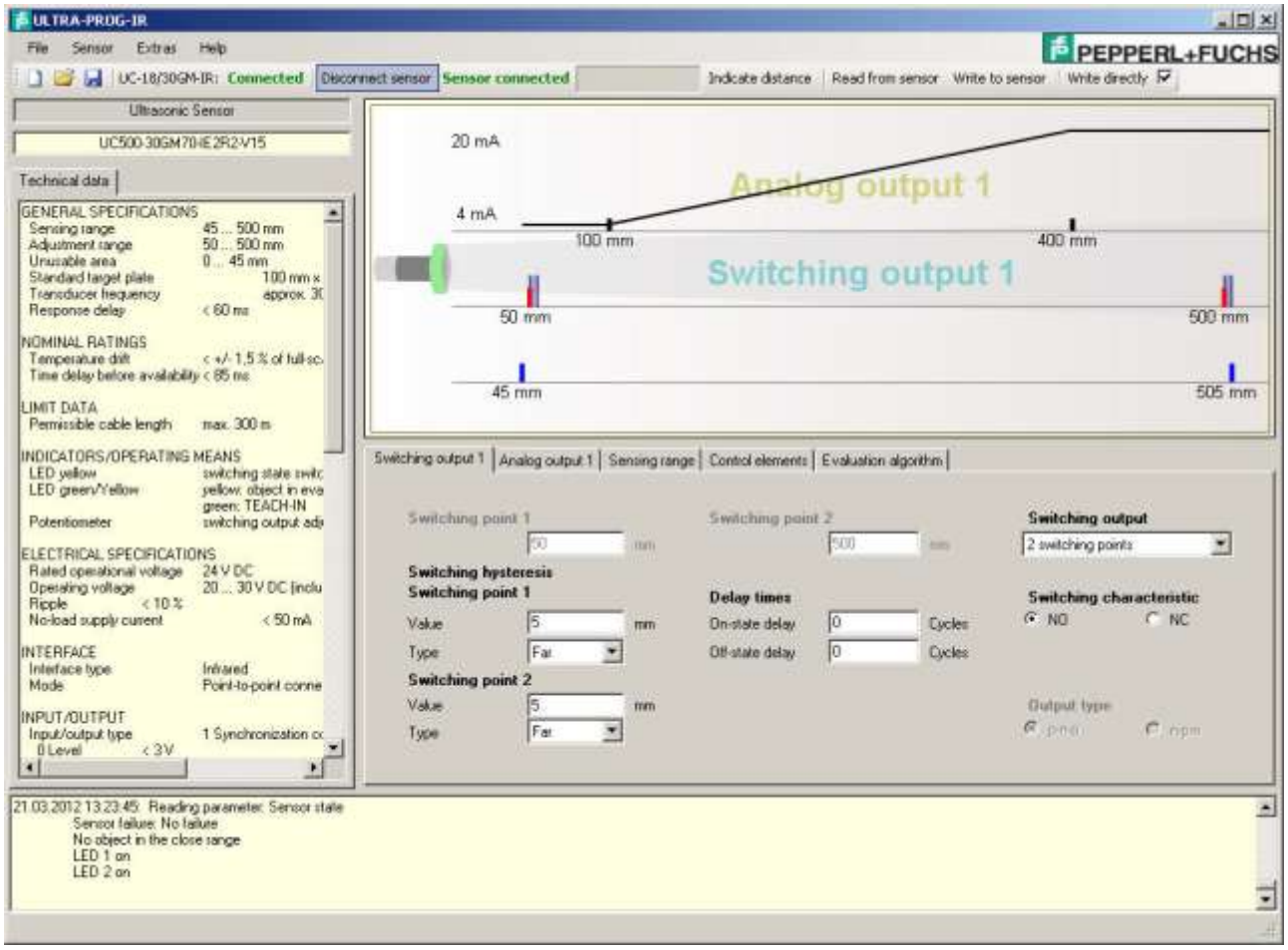
PEPPERL+FUCHS
SENSING YOUR NEEDS

Instruction Manual

Service Program ULTRA-PROG-IR

Parameterizing Software for Ultrasonic Sensors with Infrared Interface



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1 Installation of the Software ULTRA-PROG-IR

1.1 System Requirements

The software ULTRA-PROG-IR is executable on every PC or notebook.
For the communication with an IR-Interface UC-18/30GM-IR, a free USB2.0 port is required.
For the installation of the software, a free memory of about 5 MB on a storage device is required.

The software may be deployed with the following operating systems:

- Windows XP Service Pack 3
- Windows Vista Business
- Windows 7 (32 bit versions)

1.2 Installation

1.2.1 First Installation

You can download the software ULTRA-PROG-IR from the Pepperl+Fuchs Internet portal. For installation, start the file *setup.exe*. Follow the instructions during setup. The installation path is preset to *C:\Program Files\ULTRA-PROG-IR*. You can change the path during installation. After setup is completed successfully, the software is ready to use.

1.2.2 Installing an Update

Updates are provided at the Pepperl+Fuchs Internet portal. Uninstalling older versions is not necessary before installing an update. Older versions are replaced by the update and are no longer available after the update installation.

1.2.3 Uninstalling

You can use Windows System Control for uninstalling the software ULTRA-PROG-IR.

2 Specific Features of the Software ULTRA-PROG-IR

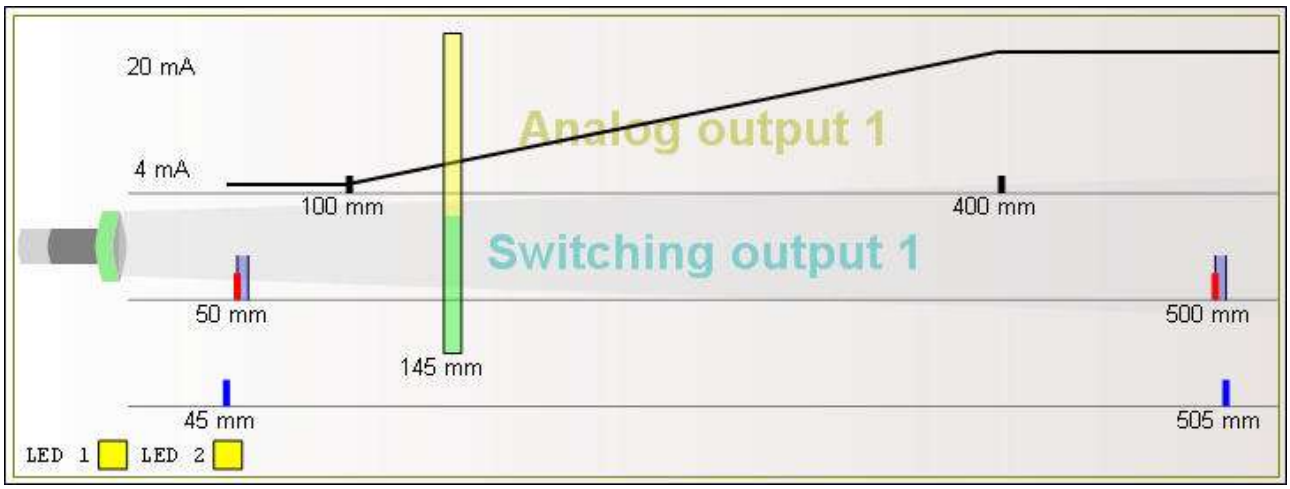
2.1 Displaying Measured Values and Diagnostics in Real Time

Every reading access on the parameters and process data of the sensor is effected in real time. "Real time" refers to the cyclical transmission of the sensor data in line with the measuring cycle of the sensor. Thus, reading accesses to the sensor parameters and its process data do not interrupt the measuring operation of the sensor. The communication via infrared is effected during the breaks of the measuring cycle. A writing access on the sensor can extend the measuring cycle as the changed parameter values have to be saved in the ROM of the sensor.

This cyclical reading of measured values in real time allows an optimum diagnostics for adapting the sensor to the application.
In addition to the object distance, for example, the signal strength of the sound reflection at the object is transmitted as well. With this information, the object to be detected can be arranged optimally in the application.

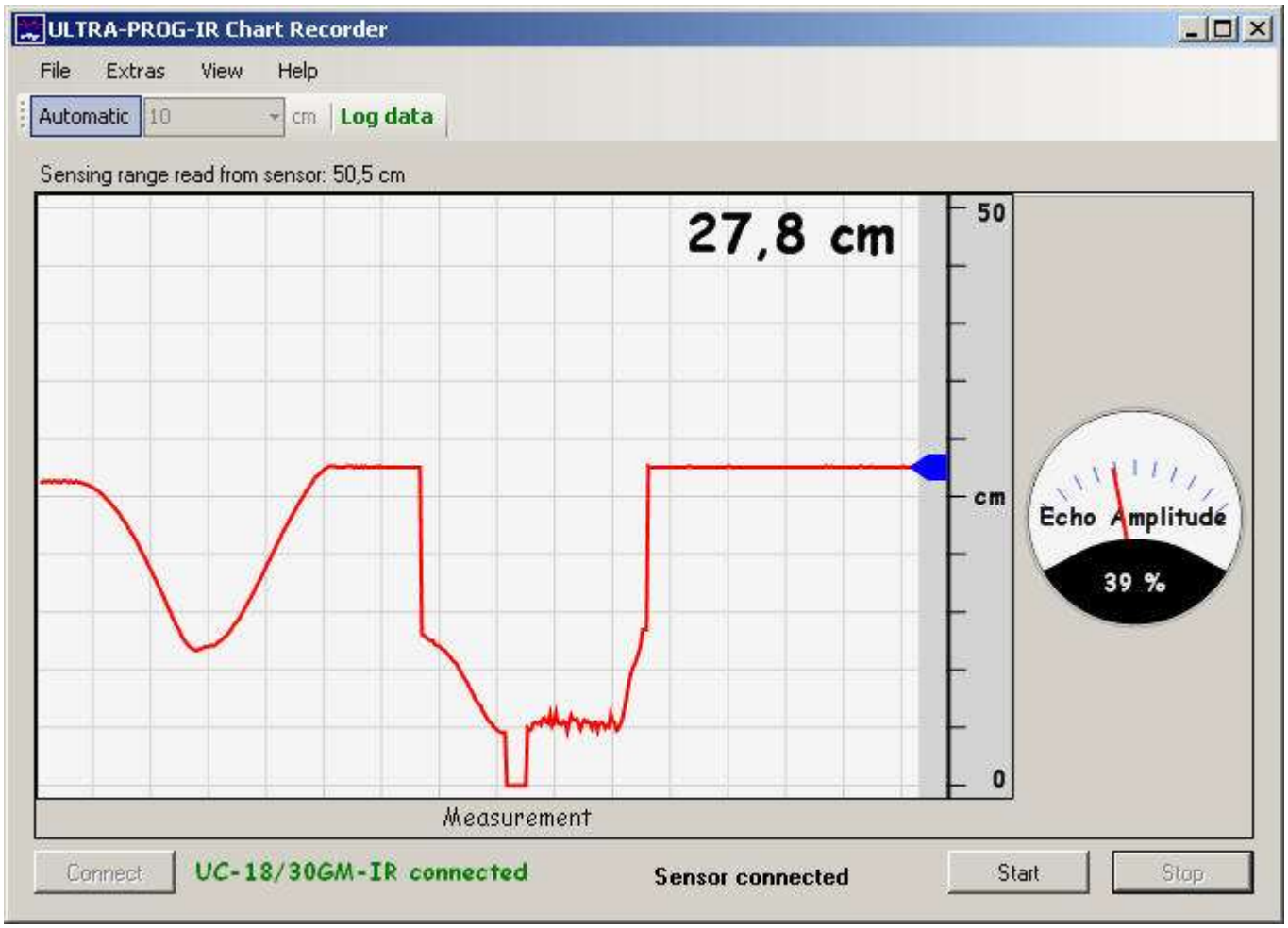
The following details of the process data are available:

- Object distance
- Signal strength of the sound reflection at the object
- Internal temperature for compensation of the speed of sound
- Noise level of the internal circuitry for a qualitative evaluation of the application environment



2.2 Chart Recorder and Data Logger

The chart recorder can record object distances with the associated signal strengths of the sound reflection at the object over time. The recording speed is adjustable in five levels.



For measuring cycle times of more than 5 milliseconds, the data logger continuously records measured values without any loss of measuring cycles. The measured values are first filed in the RAM of the PC. After completion of the recording phase, the user can assign a file name and path for the filing on a storage medium. The recording format is CSV (Comma-Separated Values) and can be read and processed with, for example, Microsoft Excel.

The expected file size can be calculated using the following formula:

file size = size of data packet * recording duration / measuring cycle time + 82 bytes

Overview about data packet sizes:

Echo telegram	Minimal size of a data packet	Typical size of a data packet	Maximum size of a data packet
MEASURED VALUE	13 bytes	17 bytes	20 bytes
ECHO1	26 bytes	32 bytes	38 bytes
ECHO3	38 bytes	51 bytes	70 bytes
ECHO5	50 bytes	70 bytes	90 bytes

Example:
Recording of the MEASURED VALUE telegram of a UC500 with a measuring cycle time of 14 ms over a duration of one hour:
expected file size (typical) = 17 bytes * 3,600,000 ms / 14 ms + 82 bytes = 4,371,511 bytes = 4.17 MB

3 Settings at the Ultrasonic Sensor with the Software ULTRA-PROG-IR

3.1 Settings for Switching Outputs

Depending on the connected type of sensor, different tabs are arranged on the user interface of the software ULTRA-PROG-IR.
The tab 'Switching Output 1' or 'Switching Output 2' is only available for sensor types with one or two switching outputs and allows settings for the switching outputs of the sensor.

The following settings can be made in the tab 'Switching Output 1' or 'Switching Output 2':

3.1.1 Operating mode of the switching output

Switching output inactive:
In this mode, the switching output is inactive, i.e. no switching signal is emitted.

1 switching point:
There is one switching point available. The switching point can be set in the whole sensing range. This operating mode is particularly suitable for blanking the background.

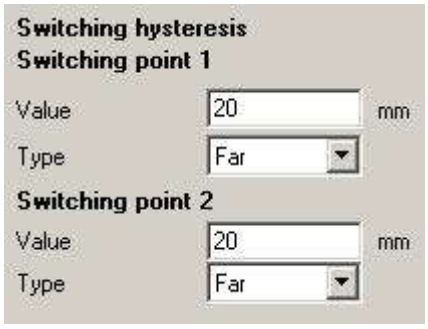
2 switching points:
There are two switching points available. Both switching points together make up a switching window. The switching window can be set in the whole sensing range.
Switching point 1 must be set smaller than switching point 2. If switching point 1 is set higher than switching point 2, the LED associated with the switching output flashes with a frequency of about 5 Hz. In this mode, the switching characteristics are not defined.
For the ultrasonic diffuse barrier sensor mode, always two switching points are required.

Alarm output:
The alarm output does not report the presence of an object, but reports if the signal-to-noise ratio of the echo signal of an object falls below a critical value. Thus, the alarm output sends a warning shortly before the sensor loses the echo signal of an object. The critical value, named alarm amplitude, can be set in the range from 0...100 %. The setting for the alarm output is only available for switching output 2.

3.1.2 Switching points

For switching point 1 and switching point 2, a value can be set in millimeter respectively if the respective switching point is active. Switching point 1 must be set smaller than switching point 2. If a switching point can be set with the potentiometer, it cannot be changed with the software ULTRA-PROG-IR.

3.1.3 Switching hystereses



For each active switching point, a corresponding switching hysteresis in millimeter can be set. Make sure that the switching point with its corresponding switching hysteresis does not exceed the sensing range. Furthermore, there are four different types of switching hystereses:

Far switching hysteresis:
The switching hysteresis is effective if an object moves from a near distance to a far distance.

Near switching hysteresis:
The switching hysteresis is effective if an object moves from a far distance to a near distance.

Symmetrical switching hysteresis:
Half of the switching hysteresis is effective if an object moves from a far distance to a near distance. The second half of the switching hysteresis is effective if an object moves from a near distance to a far distance.

No switching hysteresis:
The switching hysteresis is not effective.

3.1.4 Switching characteristics

Two different switching characteristics are available that correspond to the characteristics of a switch with NO contact or NC contact functionality. If the function NO contact is activated, the switch closes if an object is located in the switching range, i.e. the switching output is switched to supply voltage. If no object is located in the switching range, the switch opens, i.e. no switching signal is output at the switching output. The switching characteristics are exactly vice versa if the function NC contact is activated.

3.1.5 Delay times

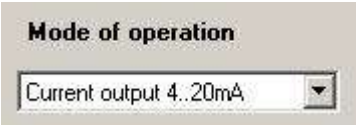
It is possible to delay switching on or off the output. Both delay times can be extended by an integer number of measuring cycles. The delay times can be set in the range from 0...255 measuring cycles.

3.2 Settings for Analog Output

Depending on the connected type of sensor, different tabs are arranged on the user interface of the software ULTRA-PROG-IR.
The tab 'Analog Output' is only available for sensor types with an analog output 4...20 mA, 0...20 mA or 0...10 V and allows settings for the analog output of the sensor.

The following settings can be made in the tab 'Analog Output':

3.2.1 Operating mode of the analog output



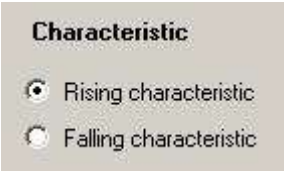
Current output 0...20 mA:
The distance of an object in the analog range is output at the analog output in the range 0...20 mA. This setting is only available for sensors with analog outputs 4...20 mA or 0...20 mA.

Current output 4...20 mA:
The distance of an object in the analog range is output at the analog output in the range 4...20 mA. This setting is only available for sensors with analog outputs 4...20 mA or 0...20 mA.

Voltage output:
The distance of an object in the analog range is output at the analog output in the range 0...10 V. This setting is only available for sensors with analog output 0...10 V.

Analog output inactive:
In this mode, the analog output is inactive, i.e. the output is constantly 0 mA or 0 V.

3.2.2 Characteristic

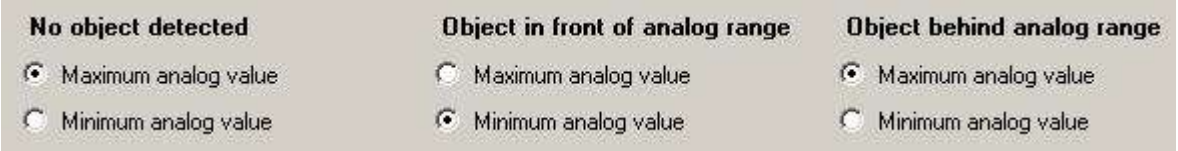


It is possible to set a rising or a falling characteristic. In the case of a rising characteristic, the current or the voltage at the analog output rises with increasing object distances. In the case of a falling characteristic, the current or voltage at the analog output falls with increasing object distances.

3.2.3 Analog range

In the set analog range, the current or voltage of the analog output is output depending on the distance. The start value of the analog range must be smaller than the end value. The analog range can be located anywhere within the sensing range.

3.2.4 Behavior outside the analog range



The behavior of the analog output outside the analog range can be set for the following three modes:

No object detected:
The behavior of the analog output if no object is detected.

Object in front of the analog range:
The behavior of the analog output if an object is located in front of the analog range from the sensor's perspective.

Object behind the analog range:
The behavior of the analog output if an object is located behind the analog range from the sensor's perspective.

For every mode, you can define if the maximum or the minimum analog value shall be output at the analog output. The minimal analog value corresponds to 0 mA for sensors with analog output 0...20 mA, 4 mA for sensors with analog output 4...20 mA, or 0 V for sensors with analog output 0...10 V. The maximal analog value corresponds to 20 mA for sensors with analog outputs 0...20 mA or 4...20 mA, or 10 V for sensors with analog output 0...10 V.

3.3 Settings for Sensing Range

Depending on the connected type of sensor, different tabs are arranged on the user interface of the software ULTRA-PROG-IR.
The tab 'Sensing Range' is available for all sensor types and allows settings for the sensing range of the sensor.

The following settings can be made in the tab 'Sensing Range':

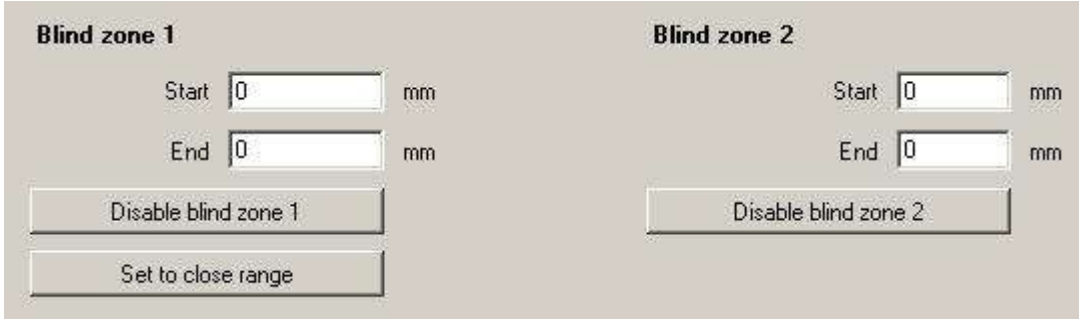
3.3.1 Close range

For direct detection sensors, the close range is caused by the switching of the sensor from transmitting to receiving mode. After the ultrasound has been sent, the ultrasound converter has to die away before ultrasonic echos can be detected. In this time or in this range, objects can be detected only to a limited extent. The size of the close range is defined physically. The indication of the close range is provided for information only and cannot be changed by the user.

3.3.2 Sensing range

The sensing range is the range where objects can be detected. The sensing range starts at the end of the close range and ends at the set value in millimeter. All objects that are located outside the set sensing range are logically blanked out. Only the technical service staff can set the sensing range. The end of the sensing range can be set in the range between the end of the close range and 10,100 mm. However, not all sensors are physically capable of detecting objects up to the maximum possible sensing range. Extending the sensing range usually increases also the cycle time and thus the response time of the sensor.

3.3.3 Blind zones



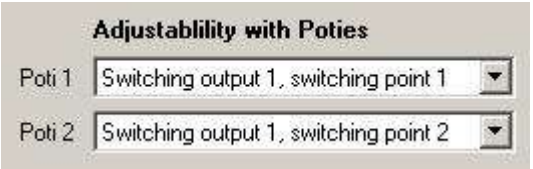
A blind zone is a range where no objects can be detected. In this range, the sensor is "blind". If an object is located in the blind zone, the sensor acts as if no object is detectable in the sensing range. The blind zones can be defined by the user at any desired range in the close and sensing range. You can set up to two independent blind zones. Blind zones receive a red mark on the software interface. The use of blind zones is particularly suitable for areas where no useful objects occur, but in which disturbing reflections occur due to their mounting.

3.4 Settings for Control Elements

Depending on the connected type of sensor, different tabs are arranged on the user interface of the software ULTRA-PROG-IR.
The tab 'Adjustment Type' is available for every type of sensor and allows settings for the control elements of the sensor.

The following settings can be made in the tab 'Adjustment Type':

3.4.1 Adjustability with the potentiometer

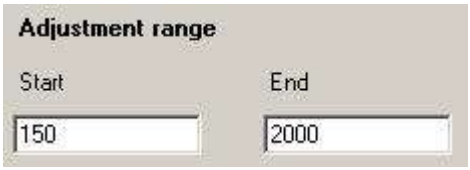


For potentiometer 1 and potentiometer 2, a range limit can be set that is adjustable with the respective potentiometer. It is also possible to deactivate one or both potentiometers.

Depending on the type of sensor, the following range limits can be selected:

- Switching point 1 of switching output 1
- Switching point 2 of switching output 1
- Switching point 1 of switching output 2
- Switching point 2 of switching output 2
- Start of analog range
- End of analog range

3.4.2 Adjustment range of the potentiometer



The adjustment range is the range where the selected range limit can be adjusted with the potentiometer. The start of the adjustment range corresponds to the selected range limit at left stop of the potentiometer. The end of the setting range corresponds to the selected range limit at right stop of the potentiometer. The adjustment range always refers to both potentiometers if they are active.

3.4.3 Teach-In

It is possible to use the XI connection of the sensor to teach a range limit. Therefore, an object must be positioned in the desired distance. The object must be located within the sensing range of the sensor. Then, the XI connection is connected to the GND connection of the sensor. The connection must be stable for at least three seconds. After completion of the teach-in process, the green LED lights up for approx. 0.5 seconds. After that the connection of the XI connection can be separated or the teach-in process is repeated after every three seconds.

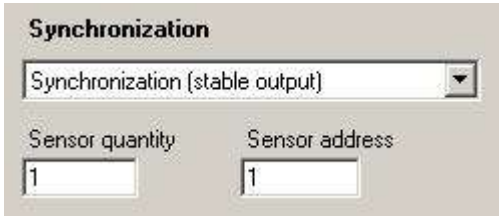
If during the teach-in process no object is located within the sensing range or the object is not detected, no range limit is taught. In this case, the sensor ignores the teach-in signal.

Depending on the type of sensor, the following range limits can be taught:

- Switching point 1 of switching output 1
- Switching point 2 of switching output 1
- Switching point 1 of switching output 2
- Switching point 2 of switching output 2
- Start of analog range
- End of analog range

The teach-in function is not activated when the sensor is delivered.

3.4.4 Synchronization and multiplex mode



If the XI connections of two or up to ten sensors are connected, the sensors synchronize. In synchronized mode, all sensors have the same cycle time and send the ultrasonic signals at the same time. For sensors with different cycle times, the common cycle time in synchronized mode is determined by the sensor with the longest cycle time. For sensors with a shorter cycle time than the cycle time in synchronized mode, the initial state outside the actual cycle time is saved. It is possible to delete the initial state during the extended cycle time.

In multiplex mode, the connected sensors work with a synchronous cycle time, too, however, the ultrasonic signal is sent alternately. Therefore, an address must be assigned to each sensor and the overall number of sensors must be set. The addresses of the sensors at the same time define the order in which the sensors send the ultrasonic signals. In multiplex mode, the XI connections of the sensors must be connected and then energized altogether at the same time.

While the XI connection is set to teach-in, the synchronization and the multiplex mode are both automatically inactive.

3.5 Settings at Evaluation Algorithm

Depending on the connected type of sensor, different tabs are arranged on the user interface of the software ULTRA-PROG-IR.
The tab "Evaluation" is available for every sensor type and allows settings at the evaluation algorithm of the sensor.

The following settings can be made in the tab "Evaluation":

3.5.1 Operating mode

Sensor locked:
In this mode, the sensor does not send any ultrasonic pulses. The object distance that was last measured is saved as long as the sensor is energized. The sensor remains ready for operation, i.e. further settings with the potentiometer or the software ULTRA-PROG-IR can be made.

Direct detection sensor:
In the operating mode 'Direct detection sensor', the object serves as sound reflector. Thus, the sensing range depends on the reflectivity of the object, i.e. on the condition of the surface and the angle of attack.

The presence of an object in the sensing range is displayed by means of a binary signal at the switching output or an analog distance signal at an analog output.

Ultrasonic diffuse barrier sensor:
In this operating mode, the ultrasound is reflected at a fixed object. This object serves as reference object and is detected by the sensor as long as there is no other object between the sensor and the reference object. Objects that move between the sensor and the reference object, are detected due to the change in the measured distance or due to the missing signal from the reference object. Using this procedure, objects with minor ultrasound reflectivity can be securely detected.

Thru-beam sensor:
In the operating mode 'Thru-beam sensor', the sensor serves either as transmitter or receiver. Thus, for thru-beam mode at least two sensors are required to create an ultrasonic thru-beam sensor. Transmitter and receiver are mounted opposite each other. To ensure a correct thru-beam mode, transmitter and receiver have to be synchronized, i.e. the XI connections of both sensors have to be connected with each other. If an object impedes the sound propagation along the ultrasound signal path this causes a switching at the receiver. With this procedure, longer distances can be reached compared to the reflectivity principle, because the ultrasound only passes the signal path once. Furthermore, the response behavior decreases considerably as switching between transmitting and receiving mode is not necessary any more.

3.5.2 Temperature compensation

If the temperature compensation is on, the indicated value in the datasheet concerning measurement accuracy applies for the whole temperature range. If the temperature compensation is off, a measurement deviation applies, based on +20 °C. With increasing temperatures, a measurement deviation of -0.17 %/K applies, with decreasing temperatures, the measurement deviation is +0.17 %/K.

3.5.3 Sensitivity

Using this value given in percent, you can change the sensitivity of the ultrasonic receiver. The smaller the sensitivity is set, the slimmer and shorter the sound cone of the sensor becomes. The sensitivity may be set in the range 0...100 %.

3.5.4 Sound cone width

This value given in percent indicates the sound cone width of the sensor. The smaller the sound cone width is set, the slimmer the sound cone of the sensor becomes. At settings from 40...100 %, the maximum effective operating range remains constant. At settings from 0...39 %, the sound cone becomes both slimmer and shorter.

3.5.5 Cycle time

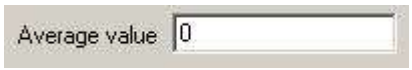
Here, the cycle time of the sensor is given in milliseconds. The cycle time means the repeating time of the ultrasonic pulse, i.e. after the cycle time has passed, the ultrasound is sent again. The setting of the cycle time is reserved to the technical service staff. Settings between 5...131 ms are possible. The full range, however, is not available for all sensor types.

3.5.6 Evaluation method

First echo:
This evaluation method uses the first echo for evaluation, i.e. the object that is closest to the sensor and reflects ultrasound to the sensor is detected and used for the operation of the outputs. This method is the usual evaluation method.

Maximum amplitude:
In this method, the echo that has the strongest signal strength concerning the reflected ultrasound is used for the evaluation. Objects with a minor sound reflectivity or objects that are located at the margin of the sound cone are blanked out.
This evaluation method is particularly suitable for applications of level measurement as liquids usually feature a very good sound reflectivity. Disturbing edges at the container or reflection of an impeller can be blanked out with this evaluation method.

3.5.7 Average value



Using this setting, past measured values may be rated with a factor. The new measured value respectively gets the factor 1. The higher the average value is set, the more inert is the reaction of the current measured value and thus of the sensor outputs on changes. With this method, variations in the measured values can be easily compensated. Settings ranging from 0...255 are valid. Averaging is active only for object movements within the sensing range. If an objects moves into the sensing range and if before that, no other object was within the sensing range, the averaging is inactive. In this case, the response delay applies. The same applies if an object moves out of the sensing range and if no other object is located within the sensing range.

3.5.8 Filtering measured values

Filtering measured values for three measuring cycles serves the suppression of noise. Thus, sporadic noise can be filtered if they do not occur longer than two measuring cycles. If the filtering of measured values is switched off, lower response times can be reached. If the sensor is deployed in an environment with possible electromagnetic interferences, the filtering of measured values should not be deactivated.

4 Legal Notice

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