

CHOR-IQ

Optical Smoke Detector with signal processing, siren and wireless communication in the band 868 MHz



Fig 1: Detector CHOR-IQ:



Fig 2: Standard CHOR Base

Description

ICAS optical detector Model CHOR-IQ is a battery operated, IQ wireless system or autonomous detector which can be connected either in peer-to peer wireless loop or into the wireless fire alarm control panel μ CU-IQ systems.

The detector is equipped with digital signal processing, advanced digital filter, automatic adjustment of smoke sensitivity, internal diagnostics and by radio-module operating in the 868MHz band, which serves to communication between detectors or between detector and control panel - depends on wireless system configuration.

The detector CHOR-IQ is developed for dwellings, accommodation, bed and breakfast places, offices etc. as a system wireless detector connected to a wireless EN54 fire central with compatible ICAS IQ wireless system protocol.

When the detector moves from normal to fire alarm, then will be activated Siren, RED led gets on and ALARM message is sent by the radio-module. The detector has an integrated siren (85db/3m), which is controlled locally from the detector or by radio-message (for example for remote alarm indication). As soon as the smoke concentration gets under the alarm limit, the detector gets from alarm to memory state (indicated by periodical double red flashes), the siren is off and the stop message is sent.

Automatic Testing & Sensitivity control (ATS) & remote indication

Improved reliability by introducing Automatic Test and Sensitivity control to keep the sensitivity at the correct level during the lifetime of the detector. The built in micro-controller is also used to communicate with the diagnostic system DS500 (directly, by optical way or wireless way), as well as handling all internal chamber test, battery test and system diagnostics. The detector sends signal fault via yellow LED's (ref. table page 2) and Error or possibly Low Battery radio-message. The built in microcontroller is used also for outgoing message formation and received loop message evaluation. The detector allows to indicate not only its own status but also provides information about remote loop events like remote alarm, remote error, remote low battery, communication lost etc. Number of remote indication depends on IQ wireless system configuration, which determines if the specific message will be delivered to the detector.

It allows to use different number indications in peer to peer configuration and in systems with control panel, where the most remote indications could be taken over by the control panel.

Terminal-description:

1 = +U (Terminal 3,6V DC - power supply in/out)
2 = 0V (Terminal 0V - power supply, SPI signal reference)

Advanced Digital Signal-filtration (ADS)

This solution guarantees a correct signal handling and reduce nuisance, false alarms and give improved immunity against EMC. All the important events, i.e. alarms and fault, will be saved to a memory, which can save the last 32 events in order of appearance. It has no Real Time Clock function.

Read the events in each detector by your PC!

Optional equipment Diagnostic System DS500 for checking the detectors via USB-input on your PC. DS-500 is used to read the data from the detector memory (EEPROM) in a service situation. The system will identify the detector and all the data will be sent to the PC for investigation by service people, be printed, sent to service-centre or saved. CHOR-IQ enables to get the diagnostic data without any detector cover opening by optical or wireless DS-IQ option.

Installation

1. Choose the best place to fix the detector. It shall be mounted in the ceiling. Min. 0,5m from walls, max. 1,5m from bedroom door and min. 1m from light point or other electrical equipment or ventilation outlet/fans.
2. Use 2 screws to fix the base.
3. Snap the connector on to the new battery and put it in to the detector head slot. Do it for all detectors in the system. During the start up time, the detector will give 2 short yellow blink every 4. sec. in 30 sec. Do not start up the detectors in an environment with smoke. (The sensitivity can be set wrongly and error message would be generated).
4. Configure wireless system with control panel or peer to peer loop before detector placing (see Appendix 2 for details)
5. Place the detector head into the base, then turn the head clockwise approx. until locked.
6. Do the test by short press of button on any detector or use control unit to test IQ Loop (see manual μ CU-IQ).
7. Check the test broadcasting in the system. Test can be stopped by press of any detector button or from the control panel. The test will be stopped even automatically after about 1 minute
8. To remove the detector, turn anti-clockwise.

Note: It is not possible to mount the alarm in the base without the battery!

Test

Sampling is done every 8 sec. If during this period smoke is detected, the detector will be sampling every second before an alarm is being released. Every positive smoke sample is indicated by red flash in this pre-alarm period. If the amount of smoke is reduced, or what look like smoke is reduced, the detector will not release an alarm.

The smoke detector should be tested regular with test gas using a small box covering the detector after it has been sprayed. After approximately 10 seconds, the red led will start blinking every second. And shortly after it will switch to steady red light and activate the fire alarm. Make sure the test gas is kept in the detector by keeping a cover over the detector during this period of approx. 15 seconds. After an alarm the detector must be reset - by short press of the push button or by received 'R' message. This way of reset will not affect the automatic sensitivity adjustment.

The detector can be RESTARTED possibly by a long push button press - in this case the ALARM threshold is renewed according to actual chamber status - RESTART can be activated only when all test gas/smoke is removed from the tested detector.

Siren

The siren/buzzer is integrated in the detector and it is controlled by the in-built microcontroller either on the own detector status or on loop status evaluation.

The siren design allows to provide the same acoustic level for the whole battery life time.

Battery / power supply

The detector can be powered either by its own lithium battery 3.6V or from the socket through the socket terminals. In case the own battery is used, the optional application can be powered into the socket by the terminals. Power supply from the socket allows to use either large battery packs into the socket for longer operation time or use of mains powered socket with backup battery - in such case the own detector battery is not connected by battery plug. The power supply voltage is monitored by the microcontroller in the detector. The low battery indication is triggered and low battery message is generated if the battery voltage falls under low battery limit or the battery internal resistance is too high.

Software description:

The CHOR-IQ detector is controlled by application ICAS software which is installed.

The software controls the timing of processes and switch between standby mode with very low current consumption and active mode which is activated periodically by watchdog wake up technique.

This software serves for following tasks:

- chamber signal processing - the similar certified algorithm and filtration as in ICAS 500-IDO is used
- adaptive sampling - the period of chamber check is changed after positive smoke sample indication
- update of two status words - first serves internal detector status, the second for loop status
- generation of the output message for wireless loop depends on actual detector status
- wake up of the radio-module and control the data /message/ exchange between radio-module and detector
- SPI master for communication between radio-module and the in built detector microcontroller
- received message analysis and loop status word update
- indication of the detector status
- indication of the loop status - simple remote events indication by the detector
- battery check and low battery indication
- memory check and system error indication
- pushbutton interrupt processing and intelligent response to pushbutton activity which depends on current detector and loop status
- diagnostic data preparing and sending on special request

The software of the radio-module serves for the following tasks:

- Operation for joining or deleting from the specific loop, loop creating - learn mode indication
- Wake up from the SPI master and communication in SPI SLAVE mode with detector (the new message is send from radio-module into the detector and a new message from the detector is sent into the radio-module at the same time)
- Timing of transmitting time slots for wireless communication depends on its loop number in order to avoid communication collisions in one loop
- Transmitting of the message from the detector into the loop or to the IQ control panel (depends on IQ System configuration)
- Loop Message monitoring, processing and selection (the message from the loop is not automatically sent directly to the detector)

Detector status - local status indications:

Signal-colour	Signal-type	Status detector	Action / Comments
No Light	None	<ul style="list-style-type: none"> - Normal operation - Smoke sensitivity tests every 8 sec. - Loop information exchanges every 4 sec. - Radio-communication integrity tests 	
Yellow	2 short blinks every 4 sec.	<ul style="list-style-type: none"> - Start up detector after power on - Start up after RESTART operation - Automatic restart after watchdog overflow 	<ul style="list-style-type: none"> - Blinking until detector chamber is stabilised. Typical start up time period is about 30s.
	Flash every 4. sec.	<ul style="list-style-type: none"> - Chamber / Sensor faulty - Program Faulty (Check-sum error) - Event saved to memory - Fault counter increase +1. - ERROR message (E) is sent 	<ul style="list-style-type: none"> - Press and release the push-button shortly on the detector or send (R) message to clean the fault indication. - Do RESTART by the long pushbutton operation or by (x) message. If this is not working, delete the detector from the loop, remove and change detector. - If the ERROR reason is fixed the indication stopped and the C message is generated
	3 flashes every 4 sec.	<ul style="list-style-type: none"> - HUSH indication - The possible alarm is blocked for 10 minutes - The actual ALARM indication is interrupted - Siren is off 	<ul style="list-style-type: none"> - The HUSH can be triggered - by short press of the button if detector is in ALARM mode - by long press (after second beep - RED and Yellow are getting on and off) - after receiving of the H message - The HUSH mode is stopped - by short press of the button if the detector is in HUSH mode - after receiving of the R message - after RESTART -Automatically after the HUSH period (10 minutes) is over
	4 short blinks in intervals	<ul style="list-style-type: none"> - "Watch-Dog" control detects a stalled program. - Smoke/Heat sampling is done - The event being stored in memory - WD-counter increases with +1. 	<ul style="list-style-type: none"> - "Watch-Dog" period is set to about 8sec. If program freeze, it will restart the detector automatically after 8s. - Remove power from detector for 1 min. If this is not working, delete the detector from the loop, remove and change detector.
Red	One blink every 1. sec.	<ul style="list-style-type: none"> - Pre alarm. Smoke has been detected. 	<ul style="list-style-type: none"> - After the second positive smoke detection, the smoke sampling increases from 4 to 1 sec, - 10 consequently positive smoke samples are necessary for the full ALARM
	Steady RED Led	<ul style="list-style-type: none"> - Siren is on - FIRE ALARM message (F) is issued - Event is saved - Fire Alarm-counter increases +1 	<ul style="list-style-type: none"> -The indication is active only during alarm smoke condition and for about 12s after decreasing of smoke concentration below the alarm limit - The ALARM indication can be suppressed by short pushbutton press or by r message for 10 minutes (detector gets into HUSH mode than) - When reason for the ALARM is not found and there is no present smoke/aerosol, the detector can be RESTART by long press of the pushbutton (see button operations) in clean conditions. The new automatic sensitivity adjustment is accomplished by RESTART
	Blink every 1 sec., for a period less than 10sec.and then gone.	<ul style="list-style-type: none"> - PRE-ALARM indication that the smoke test discovered an object/smoke in the chamber 	<ul style="list-style-type: none"> - It could have been a smoke /aerosol or an object in the chamber, which was taken as smoke.
	2 short blinks every 4s	<ul style="list-style-type: none"> - ALARM MEMORY indication 	<ul style="list-style-type: none"> -The indication is active only after stop of full alarm indication when the alarm condition does not continue - The stop message was sent into the loop - The alarm memory can be reset by short push button press or by receiving of (R) message
	Flash every 20 minutes	<ul style="list-style-type: none"> - Battery test 	<ul style="list-style-type: none"> - The battery is loaded by the LED current during the Low battery test -The first battery test after power on or after RESTART is accomplished in one minute after new detector start
	Flash every 45 sec.	<ul style="list-style-type: none"> - Low battery indication - Beep is generated - Low battery message B is sent 	<ul style="list-style-type: none"> - Check the power supply, replace the battery by a new one - If the power supply gets to the normal, (C) message is sent and the indication will stopped. - R message will stopped the indication before next battery test - for about 20 minutes
Signal-colour	Signal-type	Status detector	Action / Comments

Red	One blink every 4. sec.	<ul style="list-style-type: none"> - Diagnostic mode - The diagnostic messages are sent by RS232 on the PG1/4 terminal and by the optical way by RED Led. -The diagnostics messages with block of diagnostics data are sent by SPI to the radio module at the same time. - The first message after the DIAGNOSTIC mode start is the long message with detector history, the following messages includes the actual detector status. The message (3) is sent by SPI before every diagnostic message first. 	<ul style="list-style-type: none"> - DIAGNOSTICS can be activated in NORMAL by a long press of the pushbutton until RED light and double beep or by press of the button during power on/RESTART operation or by message (y) The diagnostics can be stopped by short push button press if the detector is in the DIAGNOSTICS mode. The DIAGNOSTICS is stopped also after message (u) receiving. The diagnostics messages are sent in the DS-500 compatible format and can be received by serial interface or by a special wireless DS-IQ option, which is connected to the USB port.
Red and Yellow	Continuous light of both Leds	<ul style="list-style-type: none"> - TEST indication - TEST message (T) is sent - Siren beeps every 4s - Test timer is running 	<ul style="list-style-type: none"> -The TEST can be activated by short press of the button - The (T) message is sent - Press the pushbutton shortly to TEST stop and ((R) message will be sent) - The TEST will be stopped after receiving of (r) message - If no button or r message stop the test , the test will be stopped automatically after 1 minute (No message is sent)
	1 sec. period 2 short red and one yellow blinks every 4s	<ul style="list-style-type: none"> - Pre-alarm and fault indication at the same time - Alarm memory and fault indication at the same time 	<ul style="list-style-type: none"> - The same action as in case of fault indication by yellow flashes in 4s interval only Notice: The simultaneous fault indication is suppressed during the full ALARM indication

Loop status - remote indications:

Signal-colour	Signal-type	Remote status indication by the detector	Action / Comments
No Light	None	<ul style="list-style-type: none"> - Normal operation. - Loop information is exchanged every 4 sec. - Radio-communication integrity tests 	
	Sounds every 4s	<ul style="list-style-type: none"> - Remote alarm -The sound active period is different from local ALARM indication 	<ul style="list-style-type: none"> - Message (f) was received -The REMOTE alarm indication will stopped after receiving of (s) message, (q) message or (r) message - the detector gets to the NORMAL and the Q message is sent to stop all remote alarms in loop. (The detector in the local alarm - the ALARM source - holds in the ALARM mode)
Yellow	Toggle each 4s (4 sec. on / 4sec off)	<ul style="list-style-type: none"> - REMOTE ERROR indication - No sound the message (e) was received - a component in the loop is in FAULT condition and - Start up after RESTART operation - Automatic restart after watchdog overflow 	<ul style="list-style-type: none"> - Press push button shortly for stop of the REMOTE ERROR indication. The message (Q) is sent Check the loop and find the component with the local ERROR indication
	Flash every 10 sec. and beep	<ul style="list-style-type: none"> - REMOTE LOW BATTERY indication - Battery low message (b) was received 	<ul style="list-style-type: none"> - Press and release the push-button shortly on the detector or send (R) message to clean the fault indication. - Do RESTART by the long push button operation or by (x) message. If this is not working, delete the detector from the loop, remove and change detector. - If the ERROR reason is fixed the indication stopped and the C message is generated
Red and Yellow	Continuous light of both Leds	<ul style="list-style-type: none"> - TEST indication - TEST message (T) was received - Siren beeps every 4s - Test timer is running 	<ul style="list-style-type: none"> - Press the push button shortly to TEST stop, the detector gets into NORMAL and (R) message will be sent - The TEST will be stopped after receiving of (r) message - If no button or (r) message stops the test , the test will be stopped automatically after 1 minute (No message is sent)
	Flashes every 4s	<ul style="list-style-type: none"> - Communication lost indication 	

Radio module - indications and control:

(The indication LEDs for radio-module and radio-module push button are different from detector Leds and button and are located on position D10, D11 and T2 on the bottom PCB side)

Signal-colour	Signal-type	Radio module status indication	Action / Comments
Yellow	Red is OFF, Flash (100ms) every 4s	- Button T2 is pressed and hold	- Button T2 is pressed and hold - when T2 release RM switches off the Message Repeater mode
	Flash (100ms) every 4s	- Loop learning operation mode - Not added into loop	- Message L was received - Detector is not added into loop - Press and hold T2 until Yellow indication is blinking and release T2
	Blinking with 500ms period	- Loop learning operation mode - Button T2 is pressed and hold	- Button T2 is pressed and hold - RF module received message L before - Release button T2 - Confirmation message K is sent - Indication is changed to RED flashes
	1x Short Flash (100ms) followed 1x Long Flash (500ms)	- Button T2 is pressed and hold - Loop learning operation mode will be run after button release	- Button T2 is pressed and hold - Release button T2 to run loop learning mode – L message is sent - Hold T2 and wait until indication is changed at Red long Flash and Yellow Long Flash - Release button T2 to send delete message D – detector is removed from the loop
Red	Flash (100ms) every 4s	- Loop learning operation mode - Detector added into loop	- Message L was received - Detector is added into loop
Red + Yellow	1x Long Red Flash (500ms) followed 1x Long Yellow Flash (500ms)	- Button T2 is pressed and hold - Detector will be deleted from the loop after button release	- Button T2 is pressed and hold - Release button to transmit delete message D and delete detector from the loop
	Red is ON followed 1x Long Yellow Flash	- Button T2 is pressed and hold	- Button T2 is pressed and hold, - when T2 release RM switches on the Message Repeater mode – <i>use only in P2P RF local system loop!</i>

User friendly Push-button operation

The CHOR-IQ detector is trying to estimate the user intention and if the detector is in other status than normal a simple short press and release of the detector button can be the first easy solution of the most detector/loop situation like remote or local sound and indication stop etc.

Detector status	Push button activity	Results - new detector state	Output message to the SPI / loop
Normal	Short press and release	Test mode, T message	T
Test	Short press and release	Normal, R message	R
Alarm	Short press and release	Hush mode of the detector, Q message to the loop	Q
Hush	Short press and release	Normal (detector reset)	R
Error	Short press and release	Beep + Error indication is kept, Q message to the loop	Q
Low Battery	Short press and release	Normal (until new negative battery test 20min)	C
Alarm memory	Short press and release	Normal	-
Diagnostic mode	Short press and release	Normal	-
Remote Alarm	Short press and release	Normal	Q
Remote Error	Short press and release	Normal	Q
Remote Low Battery	Short press and release	Normal	Q
Communication lost	Short press and release	Normal (until new negative communication test)	-
Normal	Long press until Red and Yellow get dark (two buzzer beeps)	HUSH	-
Normal / x	Long press until Yellow Led gets on together with the longer buzzer beep	RESTART	X
Normal / x	Long press until Yellow only gets on together with (longer) buzzer beep and changes to red with a coincident double beep	DIAGNOSTICS (after restart)	X

Maintenance

The detector shall be maintained with regularity, especially against dust or other airborne particles included insects. If it is suspected insects inside the detector, the detector can be put into a clear airtight plastic bag for 24 hours, to see if any insects will get out. Be aware that dirty environment do make a wear and tear situation on the detector, and after some years they will be signalling time for change-out!!

Battery replacement:

Check the correct model of the new battery -with 3.6V

Dismount the smoke alarm from the base by turning it counter clock wise. The battery is placed in a slot in the alarm. Lift out the battery carefully and flip of the connector. **NOTE! Do not pull the wires. It may cause breakage in the wires and detector disfunction.**

Snap the connector on to the new battery and put it back in to the slot. Mount the alarm in the base by turning it clock wise.

Note: It is not possible to mount the alarm in the base without the battery!

Technical specification:

Type:	CHOR-IQ
Purpose:	Battery operated intelligent, user friendly optical smoke detector in CHOR housing with digital signal processing and optional wireless communication based on IQRF radio-module. Detector can serve as long life battery self contained detector as a component of wireless loops based on IQRF radio modules in the 868MHz band. The different RF modulation, higher RF power and different RF channel is used in order not to be disturbed by CHOR-WS system in possible close installation.
Sensitivity:	Comply with EN54-7, EN14604
Detection Method:	Optical chamber operating on the scattered light and digital signal processing
Wireless communication:	868 MHz band, CHOR-IQ wireless loop (PEER to PEER net) or sub-loop with wireless control panel μ CU-IQ (STAR net configuration) ICAS wireless communication protocol, zone supports, ICAS MASH architecture support, compatible with μ CU-IQ, certified IQRF radio-module
Power:	3,6 V VDC, Lithium battery 3600 mAh / 8500 mAh, Low battery/power supply indication (No damage power supply voltage max. 9V DC) Power supply voltage on the terminals for possible socket application available Alternative power supply from the socket by standard CHOR socket terminals (Do not use power supply from the internal battery and from the socket at the same time)
Current consumption standby:	Less than 50 μ A
Standby current of the detector: (without the radio-module)	< 15 μ A
Sound siren in ALARM:	85 dB(A) / 3 m (Comply with EN14604)
Testing:	Test gas - Pre-warning comes in 8 sec. and it is indicated by red LED flash every sec. After 10 sec (10 positive smoke samples) the detector gets into fire ALARM and red led will have steady red light. The LED lens is a push-button at the same time - the short press in Normal will trig a TEST mode - the Both Leds are lighting and the buzzer beeps periodically, test message (T) is sent by SPI and forwarded by the radio-module By use of Diagnostic system (DS-500) and PC. Test report stored in PC or printed. Wireless diagnostics is available with special wireless DS-IQ option on PC with USB and diagnostic software. The diagnostics messages are sent also by red LED by optical way or by PG1/4 terminal.
EEprom memory:	Memory stores the last 30 consecutive events. (No Timing.) The history list is readable by the Diagnostics system
Reset alarm:	Push and release the push button shortly - the detector gets into HUSH mode- if no smoke condition, disable HUSH mode by next short push button press. If a renew of sensitivity adjustment is required, press the push button for long time to detector RESTART - do it in the clean environment only (neither smoke nor aerosol in the chamber).
Temp.:	-10 °C to +55 °C
Humidity:	95%RH (No condensation)
Size:	D=110mm, H=35mm, (H=40 mm included base)

Indications:

DETECTOR STATUS	INDICATION:	SPI	RADIO
Detector Start up time:	starts by 4 x Yellow LED flash and continue by Yellow double flash every 4 sec Increment Start counter in EEPROM	'X'	-
Detector Normal condition:	standby current consumption - only red flash in very long interval - battery test	'N'	-
Test:	Start by Test button or by t message RED+YELL Led + Beep Stop by Test button or by r message	'T'	'T'
Detector Smoke catch:	RED LED flashes every positive smoke test - 1s period (during pre-alarm protective period only)	-	-
Detector FIRE ALARM:	Red LED (1s toggle) SIREN 1s toggle Alarm counter is incremented in EEPROM and an Event is recorded	'F'	'F'
Sensitivity testing:	Test aerosol – in 10 sec starts flash RED LED, after 10 samples gets to full alarm	'F'	'F'
Detector Alarm MEMORY:	after disappearing of fire condition is sent stop message periodical RED LED short double flashes (until RESET by r message or by the short push button press)	'S'	'S'
Detector ERROR:	Chamber error, program memory error Yellow LED – single flash at 4 sec intervals Error counter increment	'E'	'E'
Detector Low Battery:	Chirp + Red flash (long period)	'B'	'B'
Detector Program hangs:	Watch-Dog RESET 4 flashes by Yellow LED every WD reset WD counter in EEPROM increment	'X'	-
Detector Remote ALARM:	Starts by ' f ' message Siren indication – Sound2 until receiving of stop alarm (s), reset (r), quit (q) or hush (h) message or quit by a short button press	'f'	'F'
Detector Remote ERROR:	starts by ' e ' message, stops after 'q' or 'r' message Yellow LED – toggle 4s	'e'	'E'
Remote Detector Low Battery:	Chirp + Yellow flash	'b'	'B'
Detector Communication lost:	(loop failure) 3 times yellow flashes every 4 or 10s	'k'	
Diagnostics mode:	starts after y message or by button operation - periodical RED LED flash every 4s (until receiving of u message or r message or test button short press)	'y'	'Y'
Remote Test	Indication by both RED and Yellow LED and by BEEPs automatic recovery after about 1 min.	't'	'T'
Hush:	Activated by h message or by the short press of the test button on the detector in ALARM - it is sent 'Q' message Q to other detectors at the same time or by longer test button press	'h'	'H'
	Hush stops alarm for 10 min and sends request to stop all remote alarms No response to smoke for 10 min with an automatically recovery to the detection mode Indication of HUSH mode by Yellow 3 x flashes every 4s Possible recovery from HUSH by short button press before 10 min period expiration	-	-

Indications:**DETECTOR STATUS****INDICATION:****SPI****RADIO**

Quit:	Message q stops all remote indications (cancel an actual remote alarm or remote error) this operation can be activated by push button on any detector in remote alarm or from a control panel the local alarm is kept – it allows to find (localize) detector with local alarm/local error (If the button of detector with local alarm is used the all detectors stops siren)	'q'	'Q'
Reset:	By the push button from the Test mode or by the message r It clears the detector indications and status words – the local alarm, error, low batt, remote alarm, remote error, remote low battery, siren, and reset alarm memory the reference signal for ALARM threshold is kept (sensitivity adjustment) (Reset can be applied even in alarm condition, but the detector will indicate the alarm condition against then)	'r'	'R'
Restart:	the detector is restarted the same way as after a power voltage on – do it only in smoke / aerosol free conditions The sensitivity of the detector is set against. Restart can be done by power voltage (off /on) sequence or by a long push of the detector button or by a special instruction – message 'x'	'x'	'X'
Communication lost:	k message from the control panel must be received in every 5 minutes in the EN54 comply system application the communication lost is indicated by flashes of the detector yellow + red leds	'k'	-