Honeywell

Excel Smart I/O Compact
XFCL2A1 AND XFCL3A1

FEATURES

- **LONMARK™-compliant**
- **2-wire FT-X1 LONWORKS® bus interface (compatible with FTT10)**
- **Easily-accessible service button and service LED**
- **Flexible, configurable inputs/outputs:**
  - **Three digital inputs configurable for static pushbutton, pushbutton, or totalizing**
  - **Three analog inputs configurable as NTC20k sensor inputs or as slow digital inputs**
  - **Three normally open contact relays**
- **Up to three different switching logic tables can run simultaneously (independent of the main CPU – e.g. XL500):**
  - **Reduced LONWORKS communication**
  - **Increased reliability**
  - **Faster reaction**
- **DIN rail (wiring cabinet / fuse box) mounting and wall-mounting supported**
- **24 Vac (XFCL3A1) or 230 Vac (XFCL2A1) power supply**
- **Optional terminal protection covers for wall mounting**
- **Optional swivel label holders for wiring information (printed out via CARE)**

GENERAL

The Excel Smart I/O Compact is suitable for installation at strategic locations throughout your buildings (see Table 1 for an overview of versions).

It features three digital inputs, three analog inputs, three relay outputs, as well as an input/output functionality which supports a switching logic functionality (see Fig. 1).
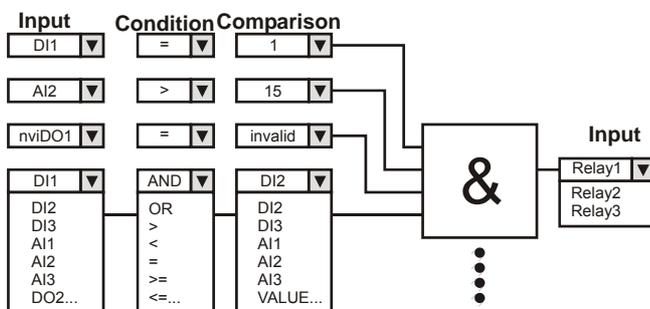

Fig. 1. Switching logic functionality

Example application 1: Monitoring of up to three spring-return damper actuators (no floating actuators)

A relay output can be used to open/close a damper, while the inputs can be used to check if the end position has been reached. This offers considerable time savings compared to manual service. (This example application does not require switching logic functionality.)

Application example 2: Switching a light via an occupancy sensor or LONWORKS

An occupancy sensor can be used to switch ON/OFF a light (with configurable hold-time) in e.g. a lavatory. This application uses the switching logic functionality and runs independently of the main CPU (e.g. XL500).

Table 1. Overview of Excel Smart I/O Compact versions

| terminal #	function	XFCL2A1	XFCL3A1
1, 2	removable LonWorks plug	X	X
3	digital input #1	X	X
4	analog input #1	X	X
5	analog input #2	X	X
6, 7, 8, 9	GND for all signals	X	X
10	digital input #2	X	X
11	digital input #3	X	X
12	analog input #3	X	X
13, 14	not used	--	--
15	common for relays 1, 2, and 3	X	X
16	relay #1 (N-O)	X	X
17	relay #2 (N-O)	X	X
18	relay #3 (N-O)	X	X
19 – 24	not used	--	--
25, 26	removable power supply plug	230 Vac	24 Vac

CE

DESCRIPTION
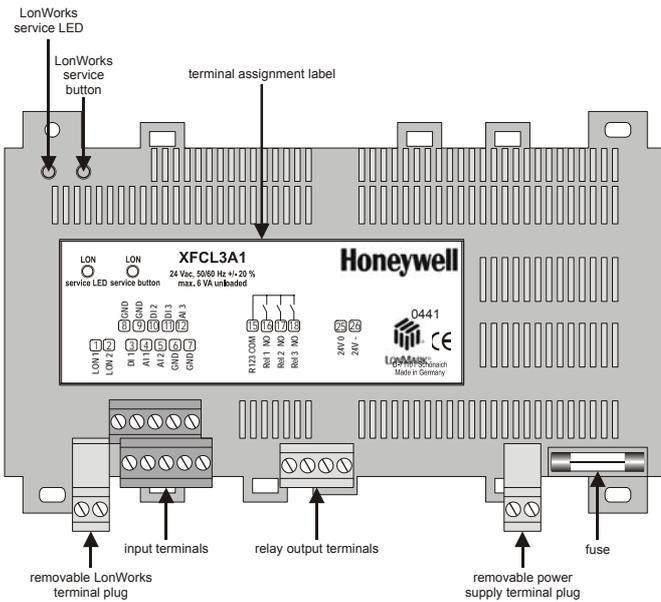
Fig. 2. Top view (optional terminal cover removed)

General

The Excel Smart I/O Compact is available in two versions with different power supply voltage:

- XFCL2A1: 230 Vac [-15% / +10%], 50/60 Hz
- XFCL3A1: 24 Vac [±20%], 50/60 Hz

Both versions have three digital inputs, three analog inputs, and three normally-open contact relays. Both versions are equipped with a LONWORKS service button and corresponding service LED.

Both versions can be equipped with optional terminal protection covers and swivel label holders (see section "Accessories").

The Excel Smart I/O Compact has a configurable receive / sent heart beat time (0…6553 s).

Analog Input Configuration Options

- NTC20k sensor input with optional sensor offset. The threshold for the LONWORKS update is configurable. A noise filter is selected by default.
- Slow DI with direct / reverse configuration option.

Table 2. Slow digital input characteristics

software detects inputs as	resistive input (dry contact)	voltage input	current out of terminal
closed	< 5 kΩ	< 1.5 Vdc	< 0.3 mA
open	> 50 kΩ	> 3.5 Vdc	< 0.1 mA

Digital Input Configuration Options

- Totalizer input; digital input 1 supports 20 Hz, digital inputs 1 and 2 support 5 Hz.
- Static digital input with direct / reverse configuration option or pushbutton for flip-flop input.

Table 3. Digital input characteristics

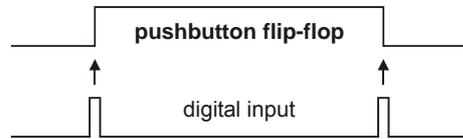| software detects inputs as	resistive input (dry contact)	voltage input	current out of terminal
closed	< 400 Ω	< 0.8 Vdc	max. 2.5 mA
open	> 1.5 kΩ	> 2.0 Vdc	0 … 1.5 mA

Fig. 3. Pushbutton for flip-flop characteristics
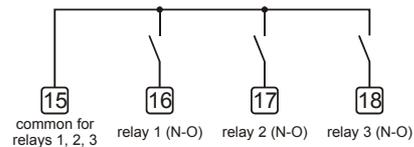
Relay Outputs

Fig. 4. Relay outputs

- Normally-open contacts with a common terminal for all three relays (max. 3 A in total).
- Configurable start-up / communication failure state (e.g. logical ON or OFF) in event of a communication failure.
- Configurable delay time and delay type (delayed ON, delayed OFF, or delayed ON and OFF.
- Configurable switching level and hysteresis.
  Example: Relay output is controlled by nviDoSwitch[1] (SNVT_switch, 0…100%). Switching level is 20% and hysteresis is 5%. The relay is switched ON at 20% and OFF at 15%.
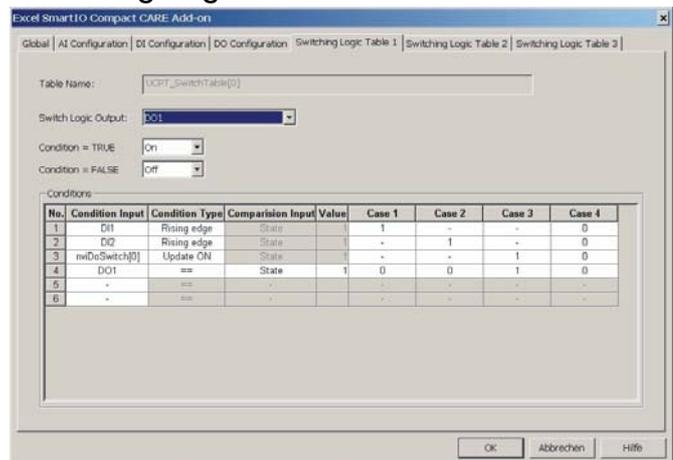
Switching Logic

Fig. 5. Switching logic table

- The switching logic functionality is configured using CARE 7.01.00 (or later).
- Excel Smart I/O Compact supports up to three switching logic tables. Each logic table may have up to six condition inputs and up to four condition cases.

- A condition input may be any of the inputs / outputs or the respective input NV's.
- The output is switched if one of the condition columns is TRUE. The relay output which will then be switched can be selected. The switching logic has a higher priority than a binding to the output.
- The following condition types may be selected: rising edge for pulse input, falling edge for pulse input, >, >=, <, <=, ==, or !=.
- The comparison value may be a fixed value e.g. totalizer value, an NV state e.g. invalid, an input NV, an input, or an output.

Behavior in the Event of Sensor Break
In the event of a break in an NTC20k sensor, the conditions "<", "<=", ">", and ">=" will be ignored.

If necessary, the break of an NTC20k sensor can be checked using the condition "=invalid".

Excel Smart I/O Compact Response Times
Response Time for NV Update
The *response time* is defined as the interval between the updating of the physical signal and the updating of the corresponding NV (or vice versa). Response times vary somewhat due to various factors. Assuming that only a single digital input changes at any given time, the corresponding response times is approx. 1.5 s. Thus, depending upon your specific circumstances, the Excel Smart I/O Compact may be suitable for rapid-response applications.

Response Time for Switching Logic
If you require a fast response time, you must use digital inputs in a switching logic table. Analog inputs used as slow digital input require a longer response time.

Typical response time for reaction to DI change:
- If only a single switching table is defined, the reaction time to a digital input change is less than 0.5 s.

Typical response time for reaction to slow DI change:
- If only a single switching table is defined, the reaction time to a slow digital input change is less than 1.5 s.

INTEROPERABILITY
The Excel Smart I/O Compact is compliant with LONMARK Application Layer Guidelines V3.3.

LONWORKS Network Interface
The Excel Smart I/O Compact is equipped with a 10-MHz 3150 Neuron® chip. It communicates within the LonWorks network at a rate of up to 78 kilo baud via an FT-X1 Free Topology Twisted Pair Transceiver (compatible with FTT10A transceivers).

Devices can be wired in daisy chain, star, or any combination thereof as long as the max. wire length requirements are met. The recommended configuration is a daisy chain with two termination modules. This layout allows for max. bus length,

and its simple structure presents the least number of possible problems, particularly when adding on to an existing bus. For more information, refer to http://www.echelon.com.

LONWORKS Service Button
All models feature a LONWORKS service button accessible from the outside (see Fig. 2).

The service pin message is broadcast on the network whenever the service button is pressed, but also after every reset (due to power-up or software reset) and whenever the mode is changed from offline to online.

LONWORKS Service LED
All models feature a LONWORKS service LED (see Fig. 2). For more information on standard service LED behavior, refer to the Excel Smart I/O Compact Installation Instructions (EN1B0282-GE51).

Configuration and Binding
The switching logic functionality is configured using Honeywell's CARE 7.01.00 (or later) tool. The I/O functionality can be configured using either CARE 7.01.00 (or later) or the LNS plug-in. The LNS plug-in cannot be used to configure the switching logic functionality.

NOTE: Do not use a browser for configuration as there is then a high risk of incorrect configuration.

LONMARK Objects
The Excel Smart I/O Compact features:
- One Node Object (Obj#0);
- Three Open-Loop Sensor objects (Obj#1-3), one for each physical universal input;
- Three Open-Loop Sensor objects (Obj#4-6), one for each physical digital input;
- Three LONMARK open-loop actuator objects (Obj#7-9), one for each relay.

LONMARK Node Object
The LONMARK node object (see Fig. 6) allows the various different objects in a node to be monitored. Upon receiving an update to nviRequest, nvoStatus is updated. The definition of SNVT_obj_request includes an object ID field to allow the node object to report status conditions for all objects in a node. The node self-documentation string lists the names of the individual LONMARK objects, allowing a network management node or tool to display useful information about an Excel Smart I/O Compact; it also states (in the optional part after the semicolon) that the node is an Excel Smart I/O Compact, and lists its version number. The Excel Smart I/O Compact has a configurable receive / sent heart beat time (0…6553 s).
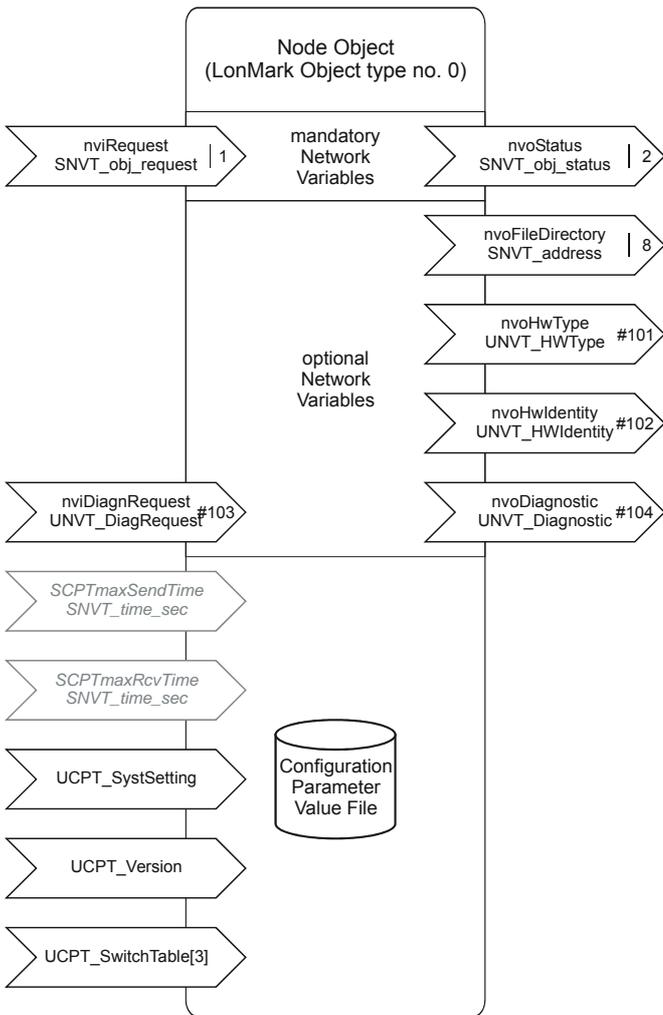
Fig. 6. Profile of LONMARK node object

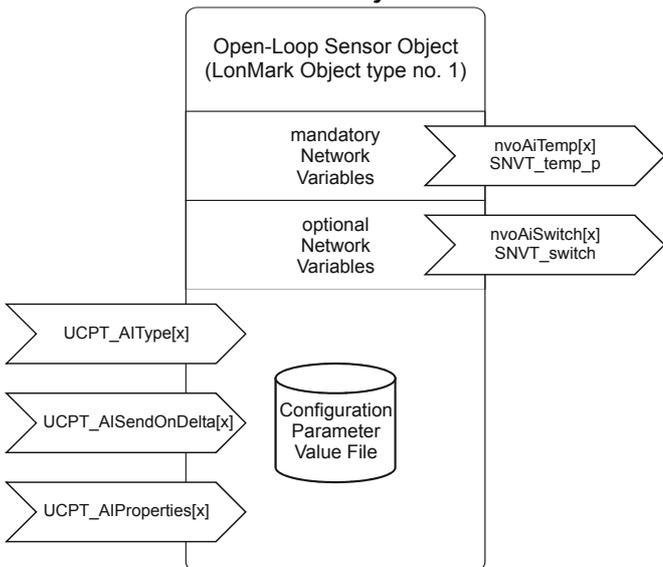## LONMARK Sensor/Actuator Objects

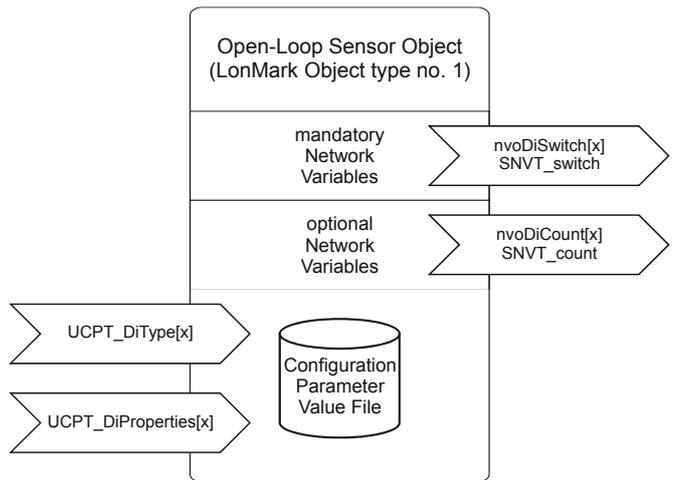**Fig. 7. Profile of LONMARK sensor objects for UIs**

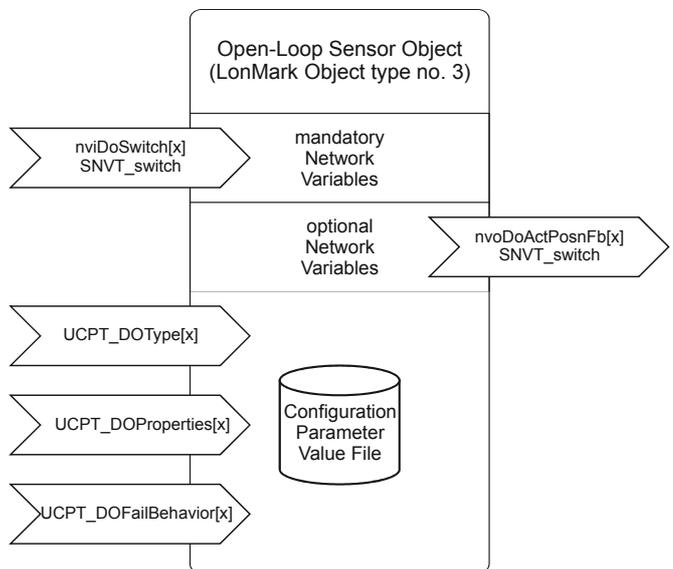**Fig. 8. Profile of LONMARK sensor objects for DIs**

Fig. 9. Profile of LONMARK actuator objects for relays

The actuator is switched by the corresponding input NV (e.g. nviDoSwitch[0]). There is one common receive heartbeat time for all input NV's supporting a receive heartbeat. The receive heartbeat time can be used for life check. A communication failure behavior can be configured to define the desired action in the event that an update of nviDoSwitch[] is missing within the configured receive heartbeat time. All sensor objects have an output NV showing the actual state of the physical output. The output NV is updated whenever there is a change. There is at least one update during the send heartbeat time. There is just one common send heartbeat time.

Table 4. Node Object network variables

NV name	type	description
nviRequest	SNVT_obj_request	RQ_NORMAL returns the object to enabled, non-overridden state.
		RQ_DISABLED disables the object.
		RQ_ENABLE enables the object.
		RQ_UPDATE_STATUS posts the current settings of the flags of the specified object.
		RQ_REPORT_MASK reports the supported flags of the specified object.
		RQ_RESET resets the appropriate LONMARK object: If the digital input object is configured for totalizing, it resets the totalizer to 65535 (0xFFFF); if associated to the node object, it resets the node. Does not have an effect on other objects.
		RQ_CLEAR_RESET requests that reset_complete be cleared.
		All other requests read to an "invalid_request" error.
nvoStatus	SNVT_obj_status	Object_id is the ID of the object within the node.
		For invalid_id, a value of "1" means that the requested object ID is not implemented in this node.
		For invalid_request, a value of "1" means that unimplemented function has been requested.
		For disabled, a value of "1" means that the object has been disabled. I/O objects not supported by the current hardware type are always disabled.
		For open_circuit, a value of "1" means that an open circuit has been detected.
		For out_of_service, a value of "1" means object not functional
		For unable_to_measure, a value of "1" means that an I/O line has failed.
		For comm_failure, a value of "1" means that network communications have failed. One or more bound input NVs specified for receive heartbeat weren't updated within the configured receive heartbeat time.
		For report_mask, a value of "1" means that the status is an event mask.
		For reset_complete, a value of "1" indicates the execution of the reset sequence. After a reset sequence, the reset flag goes to TRUE (1) and remains in this state until it is cleared (acknowledged).
nvoFileDirectory	SNVT_address	Valid range: any value within user data memory of the Neuron Chip. The value points to a file directory in the address space of the Neuron Chip. Used to access the configuration properties accessed by network management read/write messages.
nvoHwType	UNVT_HWType	Set at factory. Represents the hardware type with respect to its OS number (e.g. XFCL3A1). Typically, nvoHwType is polled for diagnostic purposes.
nvoHWIdentify	UNVT_HWIdentify	Set at factory. Used to identify the hardware by the number and types of I/Os supported by the actual hardware type. This information is passed through the LONWORKS network as a polled output NV. Typically, nvoHWIdentify is polled for diagnostic purposes.
SCPTmaxSendTime	SNVT_time_sec	Valid range: 0/10...6553 s (0 = no max. send time; 10…6553 = max. send time in seconds); in increments of 1 s (default = 60.0 s). Defines the max. time before output NVs are automatically updated (Send Heartbeat). It applies to those output NV's specified for send heartbeat.
SCPTmaxRcvTime	SNVT_time_sec	Valid range: 0/10...6553 s (0 = no max. send time; 10…6553 = max. send time in seconds); in increments of 1 s (default = 0). Defines the max. time that elapses after the last update to a bound input NV (Receive Heartbeat). Setting to zero disables the receive failure detect mechanism. It applies to those input NV's specified for receive heartbeat. In general, the receive heartbeat of the receiving device should be 3 times the send heartbeat duration of the sending device or more.
UCPT_Version		Valid range set by application program. Identifies the current application and its version. Passed through the LONWORKS network as a read-only file.

Table 4. Continued

UCPT_SwitchTable		This configuration property is used to configure the switching logic.
		SwitchLogicOutput: Logical model output associated to the switching logic (OUTP_RELAY_1 (0x4), OUTP_RELAY_2 (0x5), OUTP_RELAY_3 (0x6) or OUTP_NOT_USED (0xF))
		IfResult: Result if the condition is true (SWRES_OFF (0; 0%), SWRES_ON (1; 100%) or SWRES_NUL (3; AUTO use nviDoSwitch))
		ElseResult: Result if the condition is not true (SWRES_OFF (0; 0%), SWRES_ON (1; 100%) or SWRES_NUL (3; AUTO use nviDoSwitch))
		SwitchTableRaw **ConditionInput** COND_INPUT_AI01 (0), COND_INPUT_AI02 (1), COND_INPUT_AI03 (2), COND_INPUT_DI01 (4), COND_INPUT_DI02 (5), COND_INPUT_DI03 (6), COND_INPUT_DO01 (8), COND_INPUT_DO02 (9), COND_INPUT_DO03 (10) COND_INPUT_NVIDOSWITCH1 (12), COND_INPUT_NVIDOSWITCH2 (13), ND_INPUT_NVIDOSWITCH3 (14), COND_INPUT_NotUsed (-1) **ConditionType** CONDITION_TYPE_EQUAL (0), CONDITION_TYPE_NOT_EQUAL (1), CONDITION_TYPE_GREATER (2), CONDITION_TYPE_GREATER_EQUAL (3), CONDITION_TYPE_LESS (4), CONDITION_TYPE_LESS_EQUAL (5) **ComparisionType** COMP_TYPE_AI01 (0), COMP_TYPE_AI02 (1), COMP_TYPE_AI03 (2), COMP_TYPE_DI01 (4), COMP_TYPE_DI02 (5), COMP_TYPE_DI03 (6), COMP_TYPE_DO01 (8), COMP_TYPE_DO02 (9), COMP_TYPE_DO03 (10), COMP_TYPE_NVIDOSWITCH1 (12), COMP_TYPE_NVIDOSWITCH2 (13), COMP_TYPE_NVIDOSWITCH3 (14), COMP_TYPE_NotUsed (-1) **ComparisionValue** Temperature (-50 .. +150°C, INVALID), state (SW_ON (1), SW_OFF (0), SW_NUL (-1)), totalizer (0..65535 counts) **Note:** DI or DO used with the condition type ">1" results in a rising edge detection. DI or DO used with the condition type "<0" results in a falling edge detection.

Table 5. LONMARK sensor/actuator object NVs

NV name	type	description
nvoAiTemp	SNVT_temp_p	Transmitted immediately when its value has changed by a rate higher than the configured "Send on Delta". Regularly transmitted as a heartbeat output. nvoAiTemp represents the value measured by an AI configured as NTC20k sensor, otherwise it shows invalid.
nvoAiSwitch	SNVT_switch	Transmitted immediately when its value has changed. Regularly transmitted as a heartbeat output. nvoAiSwitch represents the value measured by an AI configured as slow DI.
UCPT_AIType	not applicable	Used to define the appropriate input type (0xFF: not used, 0: slow DI, 3: NTC20k).
UPCT_AISendDelta	not applicable	Defines the significant change rate of the associated input which should cause an immediate NV update to be sent. Applies to the universal input type when configured for "Temperature Sensor", and is ignored for other input types.
UCPT_AIProperty	not applicable	Used to define some properties associated to the analog input. **Noise Filter:** 0: disabled, 1: enabled **INVALID for sensor break:** 0: remain at last valid value after sensor break; 1: issue INVALID after sensor break; **Temperature Offset**: -5.0 K to +5.0 K in steps of 0.1 K **Slow DI contact properties:** 0: enabled on closed contact 1: disabled on closed contact
nvoDISwitch	SNVT_switch	This variable is transmitted immediately when its value has changed. The value is regularly transmitted as a heartbeat output. nvoDISwitch represents the value measured by a DI configured as fast DI. **state** **value** **Enabled:** 1 100% **Disabled:** 0 0% **not configured or object is disabled:** -1 n.a.

Table 5. Continued

nvoDICount	SNVT_count	nvoDICount represents the value measured by a DI configured as totalizer. The valid range for the totalizer count is 1... 65534. The value 0xFFFF=65535 is used to indicate a reset to the totalizer. The value is transmitted immediately when its value has changed more counts than defined in "Send on Delta". Regularly transmitted as a heartbeat output. After power-up and reset, the value 0xFFFF=65535 is sent to the network to indicate to the receiving device that previous count values have been lost due to a reset.
UCPT_DIType	not applicable	Used to define the appropriate digital input type (0xFF: not used, 0: fast digital input, 1: totalizer input).
UCPT_DIProperty	not applicable	Used to define the properties associated with a digital input. **Fast digital input:** 0: enabled on closed contact 1: disabled on closed contact **Pushbutton Setup:** 0: no pushbutton; 2: pushbutton for flip/flop; **Default after power-up / communication failure for flip-flop configuration:** 0: disabled / 0%; 1: enabled / 50%; 2: enabled / 100%; 3: INVALID; **Trigger edge:** 0: count on positive edge; 1: count on negative edge; **Send on delta:** specifies what difference in totalizer counts is required before a transmission of the value output takes place, 0..255 count; resolution 1 count;
nvoDoActPosnFb	SNVT_switch	Represents the current status of the relay. state value **Output position (ON):** 1 100% **Output position OFF:** 0 0% **not configured:** -1 0xFF This variable is transmitted immediately when the corresponding network input variable has changed. nvoDoSwitch does not support the send heartbeat time.
nviDoSwitch	SNVT_switch	Used to drive the relay. state value **OFF:** 0 n.a. **OFF:** 1 0 **switched according to configuration:** 1 0.5…100% **Invalid:** 1 n.a. This value is adopted at power-up and in case an update is not received within the specified receive heartbeat time.
UCPT_DOType	not applicable	Used to define the appropriate digital output type (0xFF: not used, 0: ON/OFF actuator).
UCPT_DOProperty	not applicable	Used to define the properties associated with a digital output. **Direct reverse:** 0: direct operation 1: reverse operation **Output delay type:** 0: no delay 1: ON delay 2: OFF delay 3: ON-OFF delay **On level:** switch ON level in %, e.g. 20% **Hysteresis:** hysteresis, e.g. switch ON at 20% and OFF at 15%, if hysteresis is 5%. **Output delay time:** 1…240 s in steps of 1 s (or 1…240 min in steps of 1 min)
UCPT_DOFailBehav	not applicable	This configuration property is used to set-up the default behavior in case of a missing network input update for the appropriate digital output. **Failure behavior:** 0: OFF 1: reserved 2: ON 3: remain in current position

Accessories, Standards, Ratings, and Literature

Accessories

- Swivel label holders; order number: XAL_LAB_L
- 209541B Termination Module (one or two required, depending on LONWORKS bus layout; see Excel 500 Installation Instructions, EN1R-1047GE51 for details).
- Terminal protection covers; order number: XAL_COV_L

Approvals and Standards

- CE and EN 50081-1
- LONMARK Application Layer Guidelines Version 3.3

Housings

- IP20 with protection covers or IP30 without protection covers.

Environmental Ratings

- Operating temperature: 32...122 °F (0...50 °C)
- Shipping/storage temperature: -22...158 °F (-30...70 °C)
- Relative humidity (operation and storage): 5...90%, non-condensing

Applicable Literature

- Excel Smart I/O Compact Installation Instructions (EN1B-0282-GE51)
- Excel 50/500 LONWORKS Mechanisms (EN0B-0270GE51)
- Excel 10 FTT/LPT 209541B Termination Module Installation Instructions, form 95-7554
- Honeywell's Excel Smart IO / Excel 12 plug-in help file

DIMENSIONS

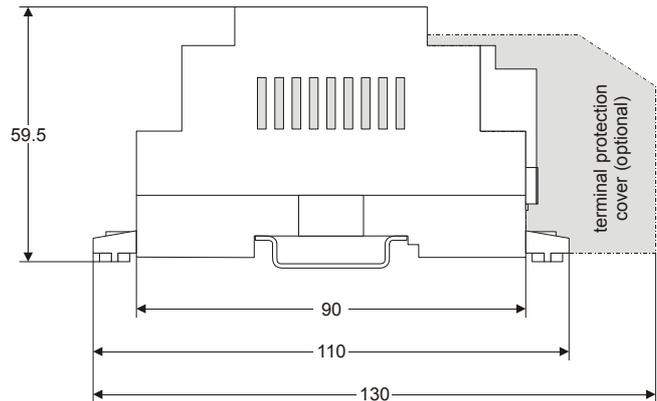All models have the same dimensions (W x L x H = 110 x 180 x 60 mm) (see Fig. 10).

Fig. 10. Excel Smart I/O Compact (dimensions in mm)

Honeywell