

Reyrolle
Protection
Devices

7SG22 - Iota

Input/Output Units with Logic Programming

Answers for energy

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7SG22 - Iota

Input/Output Units with Logic Programming



Fig 1. 7SG22

Introduction

The Iota range of Common Services Modules are programmable logic controllers designed for general application within the substation environment. Typical applications include direct replacement for hardwired relay logic schemes. PLCs developed for the industrial market typically require additional external protection to ensure reliable operation in the electrically hostile substation environment. Siemens Protection Devices Ltd has a long history of designing modular protection and control relays which can withstand the environmental extremes that an electricity substation must endure and this unit is constructed using modules already proven in this environment.

The relay consists of a combination of status inputs, output relays, current and voltage level detector modules which can be interconnected using logical elements such as AND, OR, NOT gates, pickup/drop-off timers, counters and latches to fulfil many operational interlocking requirements.

The Iota can accommodate a total of 59 input and 61 output points consisting of a combination of status inputs together with output relays. The basic models have 3 status inputs and 5 output relays on the power supply module. Additional Input and output modules can be added to the relay. The maximum number is only limited by available empty module slots in the case.

16/32 user defined LEDs are also available to the logic schemes for local indication of functions.

The voltage modules and current modules have 4 analogue channels. Each channel has a settable pick up level & time delay and its output is fed into the logic as an input. The measured values can be displayed in the instruments and are available via the IEC communications in a measurand.

Features

- Fully programmable scheme logic using Reylogic
- Programmable alarm/indication LEDs with text legend
- Analogue measurements
- Flexible number of inputs and outputs
- Fault, event and waveform recorder
- IEC60870-5-103/MODBUS fibre optic communications
- Front RS232 communication port
- IRIG-B time synchronisation input
- Continuous self monitoring

Description

Reylogic

Reylogic is a Windows based schematic capture program used for creating configuration logic diagrams for use in Iota. The inputs and outputs may be interconnected with up to 64 timers, 64 counters and 64 latches along with combinational logic consisting of AND, OR and NOT gates limited only by the choice of scan rate for the logic. The default scan rate is 2.5 milliseconds but this may be adjusted to accommodate more complex logic schemes.

The logical elements are simply dragged and dropped onto the drawing page and interconnections formed by dragging a connection wire from the output of an element to the input of another. This greatly simplifies scheme configuration over other techniques such as ladder logic used in industrial grade PLCs.

All timers and counters, drawn on a logic diagram and set to be visible, appear in the setting lists accessible via the front fascia to allow on-site modifications without having to use a PC to modify the logic diagrams. All Boolean points marked as external inputs on the schematic package appear in the settings list with a matrix setting which allows any combination of output relays and fascia flags to be selected.

Latches and counters can be configured to retain their state if the power supply is interrupted.

Fascia unit

The Iota has a user friendly HMI interface which allows simple modifications to timer and counter settings as well as simple reconfiguration of the allocation of inputs and outputs.

The input and output points are fully programmable to allow easy modification. In addition all Boolean

outputs are available in the menus and can be configured to give indications on the LED front panel. LEDs can be selected to be hand or self reset.

Measurement and Trending

Analogue values can be displayed in primary or secondary quantities on the LCD screen via the Instruments Menu. In addition the values can be obtained via the IEC60870-5-103 communications.

The IEC events can be edited to report any output Boolean state as an event.

The IEC command files can also be edited to allow remote operation of the input Booleans in the logic diagram.

Real time measurements

Primary and Secondary currents
 Primary and Secondary voltages
 Status inputs
 Output contacts

System Data

Sequence of Event records

Up to 500 events are stored and time tagged to 1ms resolution. These are available via the communications.

Fault records

The last 10 fault records are available from the Iota fascia along with time and date of operation.

Disturbance recorder

The Waveform Recorder may be triggered from a logic Boolean or an external input and has a configurable pre-fault trigger. Up to 10 seconds of fault waveforms may be stored with associated analogue and digital values. This is user configurable as ten 1-second records, five 2-second records, two 5-second records or one 10-second record.

The IEC60870-5-103 protocol allows remote operators to control plant and receive indication and metering information.

Fibre-optic communications ports are provided on the rear of the relay and will be optimised for 62.5/125µmm glass-fibre using BFOC/2.5 (ST®) bayonet-style connectors as standard.

In addition users may interrogate the Iota locally with a laptop PC via the RS232 port on the front of the relay. The Reydisp Evolution software described as follows allows the user to do this.

Support Software

Reydisp Evolution

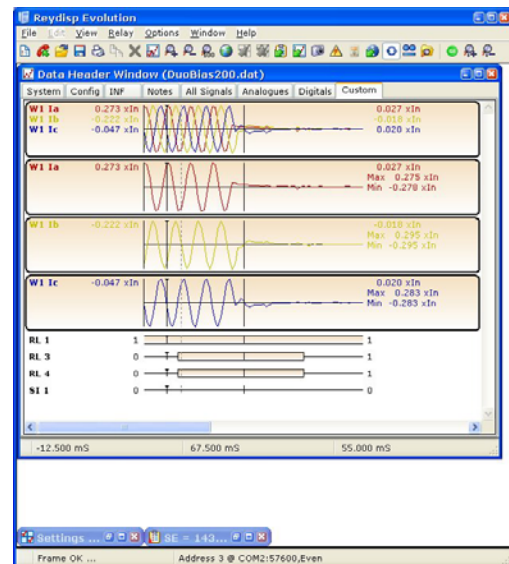


Fig 2. Typical Reydisp Evolution screenshot

Reydisp Evolution provides the means for the user to apply setting to the Iota, interrogate settings and retrieve disturbance waveforms from the relay.

Reylogic toolbox

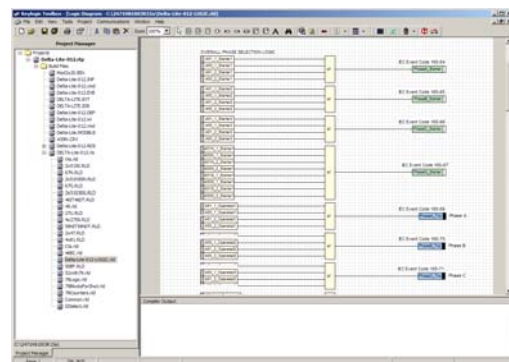


Fig 3. Example Reylogic screenshot

Reylogic allows users to design their own logic schemes and apply them to the relay. The design is built from simple building blocks of combinational logic (and, or, exclusive or) and sequential logic (timers, counters and latches). These are dropped onto the page and wired to form the scheme.

When the design is complete it can be tested offline by simulation in the Reylogic package. The test files and results can be stored as a record of the tests and for future repeatability.

The logic diagram along with IEC event and command configuration files are built into a project which can be downloaded to the Iota. The logical inputs and outputs of the scheme can then be assigned to physical inputs and outputs in the Iota in the settings file via Reydisp or fascia.

Technical Information

Performance data to IEC 60255-3

Characteristic energising quantities

AC Current	1, 5A
AC Voltage	63.5V line-neutral 110V line-line 50Hz

Auxiliary Energising Quantity DC power supply

Nominal Voltage	Operating range VDC
48, 110V	37.5 to 137.5
220V	176.0 to 280.0

DC status inputs

Nominal Voltage	Operating range VDC
30, 34V	18.0 to 37.5
48, 54V	37.5 to 60.0
110, 125V	87.5 to 137.5
220, 250V	175.0 to 280.0

The status voltage need not be the same as the main energising voltage.

Electricity Association ESI48-4

The 30/34V and 48/54V inputs meet the requirements of ESI48-4 ESI 1. However, the 110/125V and 220/250V inputs will operate with a DC current of less than 10mA. If 110/125V or 220/250V inputs compliant with ESI48-4 ESI 1 are required, an Iota with 48/54V status can be supplied with external dropper resistors as follows:

Nominal Voltage	Resistor Value	Wattage
110, 125V	2k7 ± 5%	2.5W
220, 250V	8k2 ± 5%	6.0W

Status Input Performance

Parameter	Value
Minimum DC current for operation (30/34V and 48/54V inputs only)	10mA
Reset/Operate Voltage Ratio	≥ 90%
Typical response time	< 5ms
Typical response time when used to energise an output relay contact	< 15ms
Minimum pulse duration	40ms

Each status input has an associated timer that can be programmed to give time delayed pick-up. When a 20ms pick-up setting value is applied the status inputs will not respond to the following:

- 250V RMS 50/60 Hz applied for two seconds through a 0.1µF capacitor.
- 500V RMS 50/60 Hz applied between each terminal and earth.
- Discharge of a 10µF capacitor charged to maximum DC auxiliary supply voltage.

Indication

Relay Healthy	
Method	Green LED
Healthy	Steady
Failure	Flashing or extinguished
Indication	
Method	16/32 Programmable RED LEDs
Settings and Instrumentation	
Method	Backlit LCD

Sub-station Communications

Protocol	IEC 60870-5-103/MODBUS
RS-232 interface	
Location	Fascia
Form	25-pin female D-type connector
Fibre interface	
Location	Rear
Quantity	2 x Rx, 2 x Tx
Form	BFOC/2.5 (ST®) bayonet connector
COM1	
Baud rate	75-115200 baud
Interface	Fibre-optic port
COM2	
Baud rate	75-115200 baud
Interface	Auto-switches between Fibre-optic and RS-232 ports

General Accuracy

Reference conditions

General	IEC 60255
Current Settings	100% of In
Auxiliary supply	Nominal
Frequency	50Hz
Ambient temperature	20 °C

General settings

Parameter	Value
Transient Overreach of Disengaging Time (¹)	< 42ms
Overshoot Time	< 40ms

(¹)Output contacts have a minimum dwell time of 100ms, after which the disengage time is as above.

Accuracy Influencing Factors Temperature

-10 °C to +55 °C	≤ 5% variation
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Thermal Withstand

AC Current Inputs		
continuous	Phase	3.0 xIn
10 minutes		3.5 xIn
5 minutes		4.0 xIn
2 minutes		6.0 xIn
1 second	5A Phase/Earth	400 A
	1A Phase/Earth	100 A
	5A Phase/Earth	2500 A
1 cycle	1A Phase/Earth	700 A
AC Voltage Inputs		
continuous	3.5 xVn	

Burdens

Measuring Inputs	
AC Current Inputs	
5A Phase/Earth	≤0.2 VA ≤0.01 Ω
1A Phase/Earth	≤0.05 VA ≤0.05 Ω
AC Voltage Inputs	
	≤0.01 VA

Auxiliary supply

Quiescent (Typical)	13W
Maximum	25W

Burdens are measured at nominal rating.

Output Contacts

Contact rating IEC 60255-23

Carry Continuously	5A AC or DC
Make and Carry	(L/R ≤40ms and V≤300 volts)
0.5 seconds	20A AC or DC
0.2 seconds	30A AC or DC
Break	(I≤5A and V≤300 volts)
ac resistive	1250VA
ac inductive	250VA @ PF ≤0.4
dc resistive	75W
dc inductive	30W @ L/R ≤40ms 50W @ L/R ≤10ms

Number of Operations

Minimum number of operations	1000 at maximum load
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Recommended load

Minimum recommended load	0.5W, limits 10mA or 5V
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Environmental

Temperature IEC 68-2-1/2

Operating	-10 °C to +55 °C
Storage	-25 °C to +70 °C

Humidity IEC 68-2-3

Operational test	56 days at 40 °C and 95% RH
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Transient Over voltage IEC 60255-5

Between all terminals and earth or between any two independent circuits without damage or flashover	5kV
	1.2/50 μ s
	0.5J

Insulation IEC 60255-5

RMS levels for 1 minute

Between all terminals and earth	2.0 kV
Between independent circuits	2.0 kV
Across normally open contacts	1.0 kV

Immunity

Auxiliary DC Supply IEC 60255-11	
Allowable superimposed ac component	$\leq 12\%$ of dc voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20 ms
High Frequency Disturbance IEC 60255-22-1 Class III	
2.5kV, Longitudinal mode	$\leq 3\%$ variation
1.0kV, Transverse mode	
Electrostatic Discharge IEC 60255-22-2 Class III	
8kV, Contact discharge	$\leq 5\%$ variation
Radio Frequency Interference IEC 60255-22-3	
10 V/m, 80 to 1000 MHz	$\leq 5\%$ variation
Fast Transient IEC 60255-22-4 Class IV	
4kV, 5/50ns, 2.5 kHz, repetitive	$\leq 3\%$ variation
Conducted RFI IEC 60255-22-6	
10V, 0.15 to 80 MHz	$\leq 5\%$ variation

Emissions

Conducted limits IEC 60255-25		
Frequency Range	Limits dB(mV)	
	Quasi-peak	Average
0.15 to 0.1MHz	79	66
0.5 to 30 MHz	73	60
Radiated limits IEC 60255-25		
Frequency Range	Limits at 10m	
	Quasi-peak, dB(μ V/m)	
30 to 230 MHz	40	
230 to 10000 MHz	47	

Mechanical

Vibration (Sinusoidal) IEC 60255-21-1 Class 1	
0.5 gn, Vibration response	$\leq 5\%$ variation
1.0 gn, Vibration endurance	
Shock and Bump IEC 60255-21-2 Class 1	

5 gn, Shock response, 11ms	$\leq 5\%$ variation
15 gn, Shock withstand, 11ms	
10 gn, Bump test, 16ms	
Seismic IEC 60255-21-3 Class 1	
1 gn, Seismic Response	$\leq 5\%$ variation
Mechanical Classification	
Durability	In excess of 10^6 operations

Case Dimensions

The Iota is supplied in either a size E8, size E12 or size E16 case depending on the number of analogue input sets and the status input and output requirement

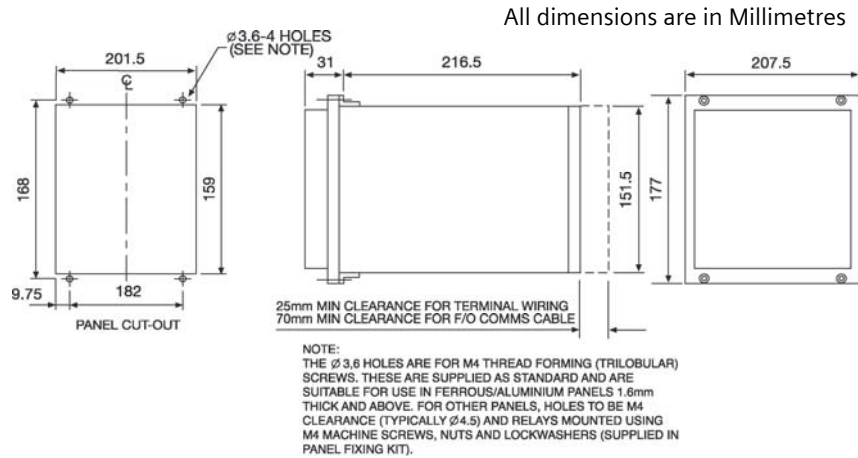


Fig 4. Epsilon E8 Case

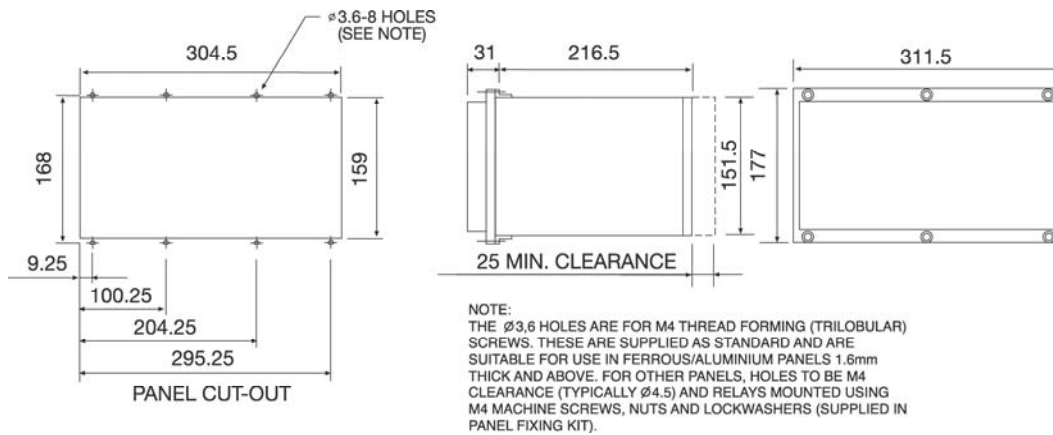


Fig 5. Epsilon E12 Case

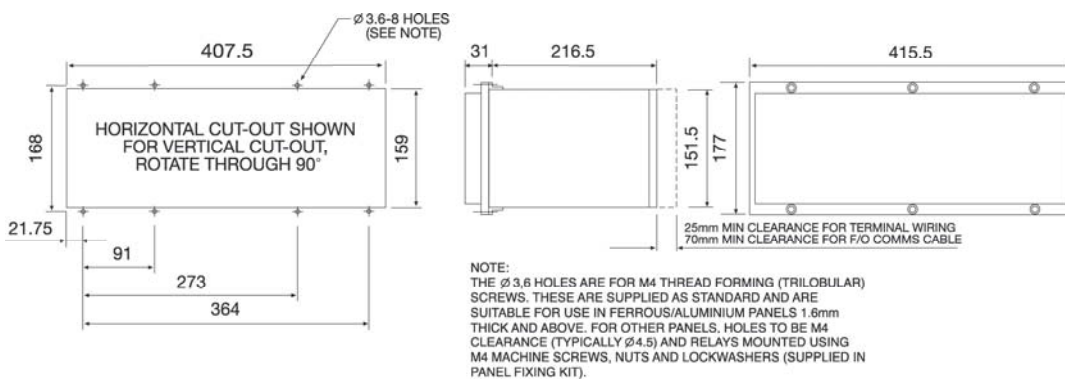


Fig 6. Epsilon E16 case

Typical Connection Diagram

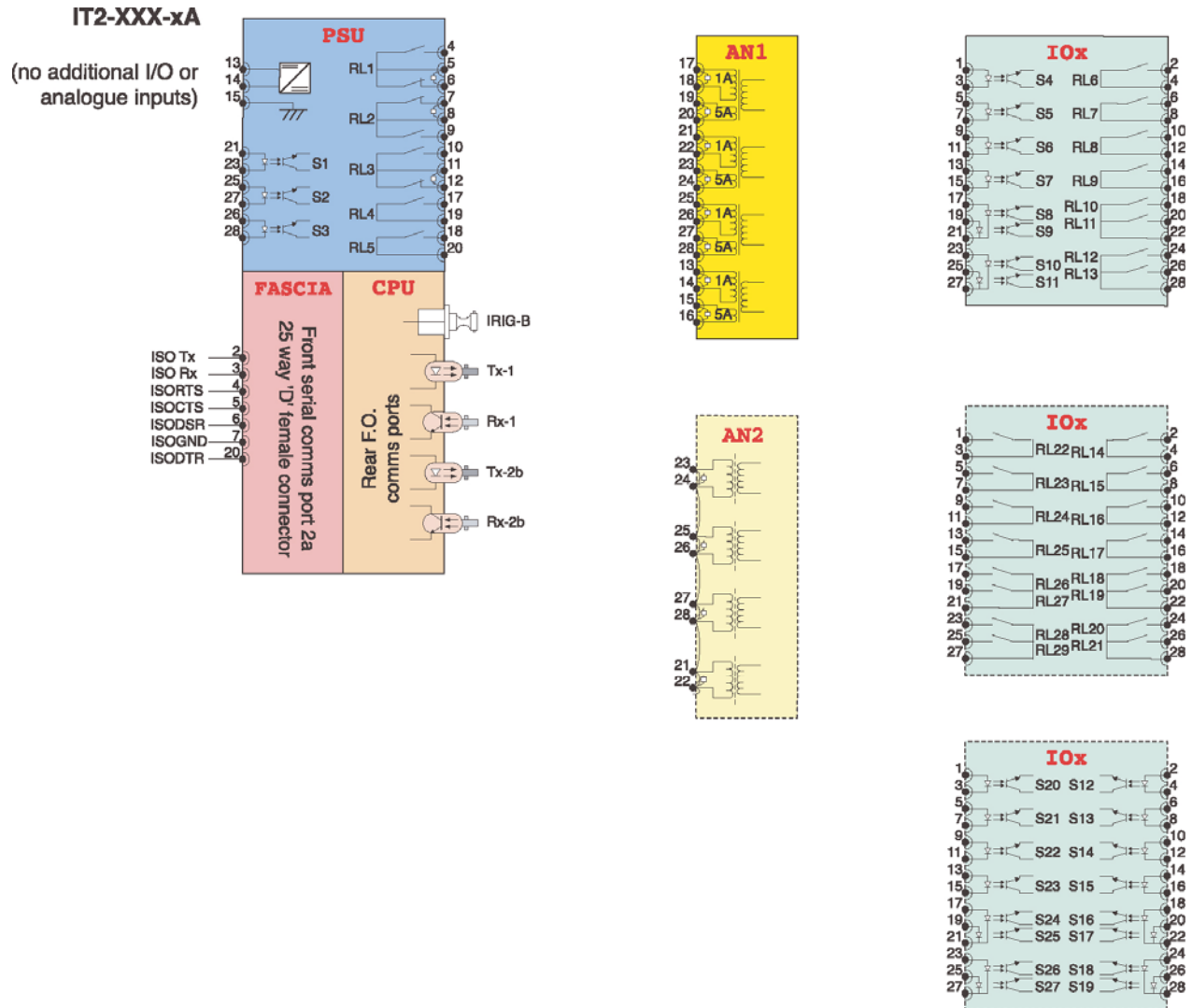


Fig 7. Typical connection diagram

Ordering Information - Iota 7SG22

Product description	Variants	Order No.
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IOTA (100 series)

Input/output units.

Relay type

100 series – Input/Output Units

Functionality

Binary Inputs and Binary Outputs, 2 module positions for additional I/O

Binary Inputs, Binary Outputs and 4 Voltage Inputs, 1 module positions for additional I/O

Binary Inputs, Binary Outputs and 4 Current Inputs, 1 module positions for additional I/O

Auxiliary supply /binary input voltage

30 V DC auxiliary, 30 V DC binary input

30 V DC auxiliary, 48 V DC binary input

48/110 V DC auxiliary, 30 V DC binary input

48/110 V DC auxiliary, 48 V DC binary input ¹⁾

48/110 V DC auxiliary, 110 V DC binary input

220 V DC auxiliary, 110 V DC binary input

220 V DC auxiliary, 220 V DC binary input

Additional I/O Modules ²⁾

3 Binary Inputs / 5 Binary Outputs (incl. 3 changeover), basic I/O

11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 1 module

19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover), 2 modules

27 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 2 modules

Frequency

Not applicable

50Hz

60Hz

Nominal current

1/ 5 A

Voltage inputs

Not applicable

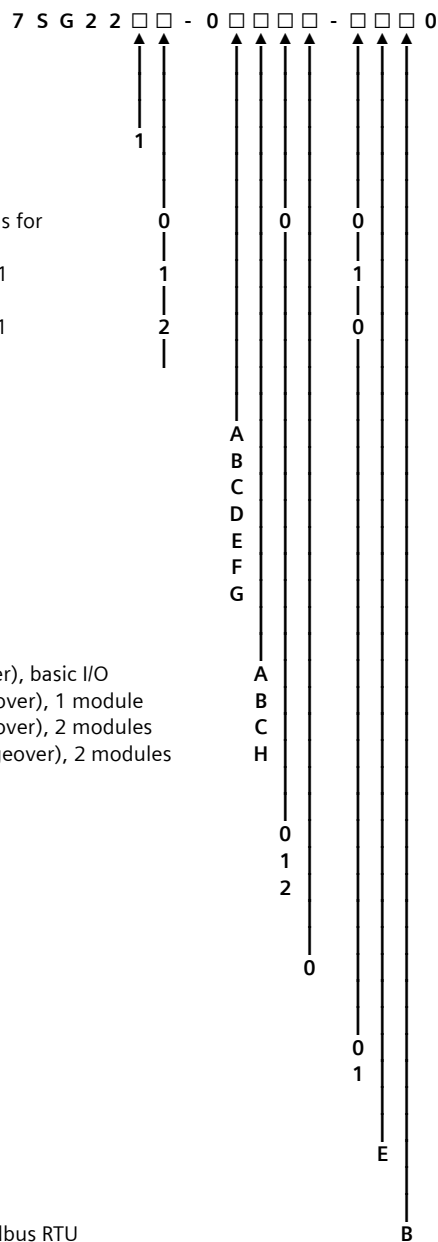
63.5/110 V AC

Housing size

Case size E8 (4U high)

Communication interface

Fibre optic (ST-connector) / IEC 60870-5-103 or Modbus RTU



¹⁾ These binary inputs may be used from 110/125V & 220/250V via external dropper resistors, order combination of the following resistor boxes to suit number of binary inputs.

- 2512H10064 (9 inputs, 110/125V)
- 2512H10065 (5 inputs, 110/125V)
- 2512H10066 (1 inputs, 110/125V)
- 2512H10067 (5 inputs, 220/250V)
- 2512H10068 (1 inputs, 220/250V)

²⁾ Additional input/output modules must not exceed available module positions.

Ordering Information - Iota 7SG22

Product description	Variants	Order No.
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IOTA (200 series)

Input/output units.

Relay type

200 series – Input/Output Units

Functionality

Binary Inputs and Binary Outputs, 4 module positions for additional I/O
 Binary Inputs, Binary Outputs and 4 Current Inputs, 3 module positions for additional I/O
 Binary Inputs, Binary Outputs and 4 Current Inputs, 3 module positions for additional I/O
 Binary Inputs, Binary Outputs, 4 Current and 4 Voltage Inputs, 2 module positions for additional I/O

Auxiliary supply /binary input voltage

30 V DC auxiliary, 30 V DC binary input
 30 V DC auxiliary, 48 V DC binary input
 48/110 V DC auxiliary, 30 V DC binary input
 48/110 V DC auxiliary, 48 V DC binary input ¹⁾
 48/110 V DC auxiliary, 110 V DC low burden binary input
 220 V DC auxiliary, 110 V DC low burden binary input
 220 V DC auxiliary, 220 V DC low burden binary input

Additional I/O Modules ²⁾

3 Binary Inputs / 5 Binary Outputs (incl. 3 changeover), basic I/O
 11 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 1 module
 19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover), 2 modules
 27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover), 3 modules
 27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover and 4 N/C), 3 modules
 27 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 2 modules
 35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover), 4 modules
 35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover and 4 N/C), 4 modules

Frequency

Not applicable
 50Hz
 60Hz

Nominal current

1/ 5 A

Voltage inputs

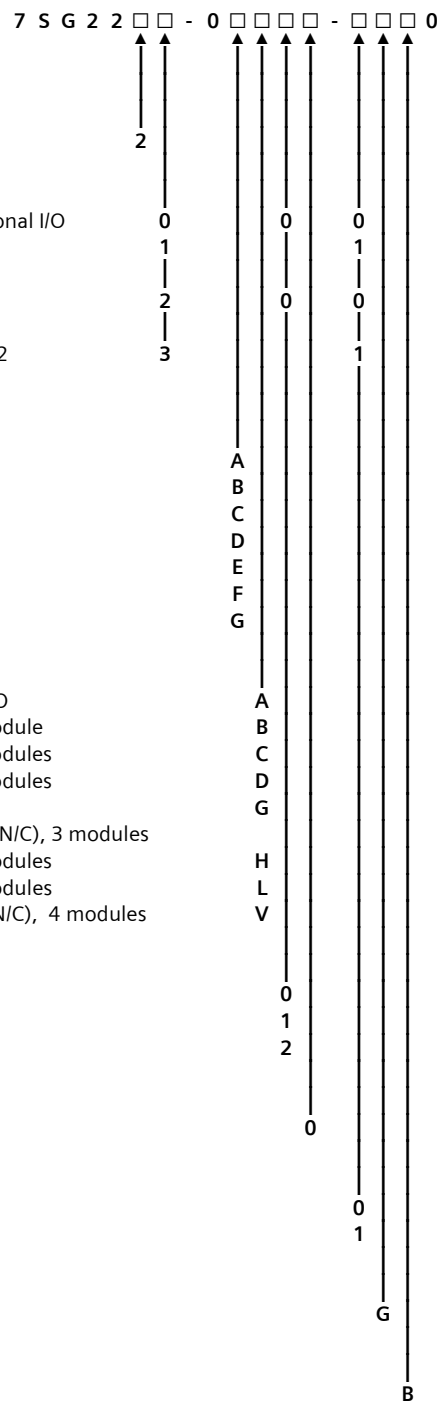
Not applicable
 63.5/110 V AC

Housing size

Case size E12 (4U high)

Communication interface

Fibre optic (ST-connector) / IEC 60870-5-103 or Modbus RTU



1) These binary inputs may be used from 110/125V & 220/250V via external dropper resistors, order combination of the following resistor boxes to suit number of binary inputs.

2512H10064 (9 inputs, 110/125V)	2512H10067 (5 inputs, 220/250V)
2512H10065 (5 inputs, 110/125V)	2512H10068 (1 inputs, 220/250V)
2512H10066 (1 inputs, 110/125V)	

²⁾ Additional input/output modules must not exceed available module positions.

Ordering Information - Iota 7SG22

Product description	Variants	Order No.
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IOTA (300 series)

Input/output units.

Relay type

300 series – Input/Output Units

Functionality

Binary Inputs and Binary Outputs, 6 module positions for additional I/O

Binary Inputs, Binary Outputs and 4 Voltage Inputs, 5 module positions for additional I/O

Binary Inputs, Binary Outputs and 4 Current Inputs, 5 module positions for additional I/O

Binary Inputs, Binary Outputs, 4 Current and 4 Voltage Inputs, 4 module positions for additional I/O

Auxiliary supply /binary input voltage

30 V DC auxiliary, 30 V DC binary input

30 V DC auxiliary, 48 V DC binary input

48/110 V DC auxiliary, 30 V DC binary input

48/110 V DC auxiliary, 48 V DC binary input ¹⁾

48/110 V DC auxiliary, 110 V DC low burden binary input

220 V DC auxiliary, 110 V DC low burden binary input

220 V DC auxiliary, 220 V DC low burden binary input

Additional I/O Modules ²⁾

19 Binary Inputs / 21 Binary Outputs (incl. 3 changeover), 2 modules

27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover), 3 modules

27 Binary Inputs / 29 Binary Outputs (incl. 3 changeover and 4 N/C), 3 modules

27 Binary Inputs / 13 Binary Outputs (incl. 3 changeover), 2 modules

35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover), 4 modules

43 Binary Inputs / 45 Binary Outputs (incl. 3 changeover), 5 modules

43 Binary Inputs / 45 Binary Outputs (incl. 3 changeover AND 4 N/C), 5 modules

51 Binary Inputs / 53 Binary Outputs (incl. 3 changeover), 6 modules

59 Binary Inputs / 45 Binary Outputs (incl. 3 changeover), 6 modules

35 Binary Inputs / 37 Binary Outputs (incl. 3 changeover and 4 N/C), 4 modules

Frequency

Not applicable

50Hz

60Hz

Nominal current

1/ 5 A

Voltage inputs

Not applicable

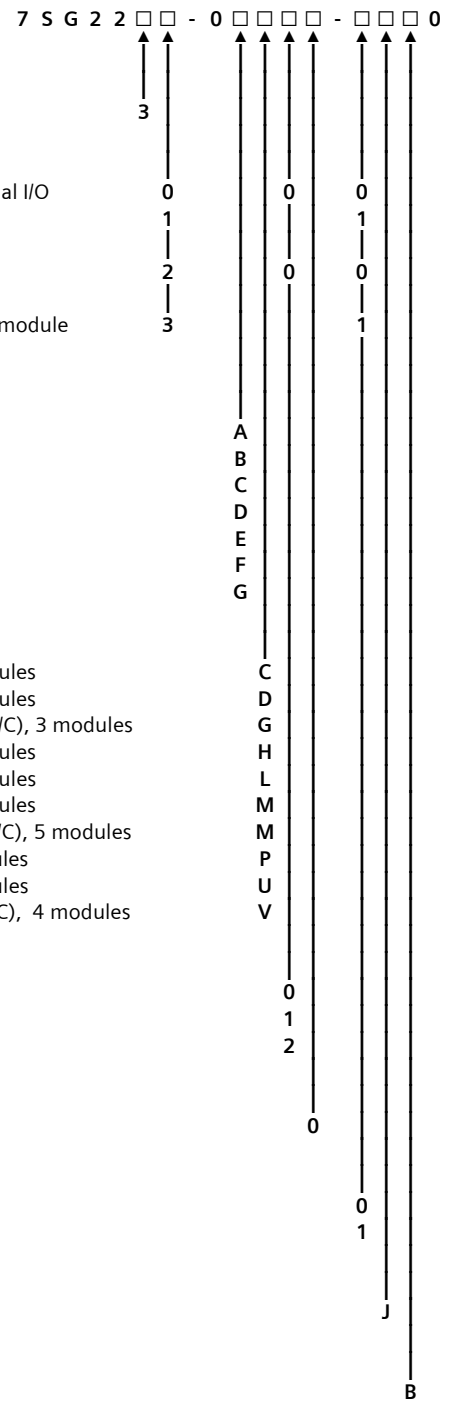
63.5/110 V AC

Housing size

Case size E16 (4U high)

Communication interface

Fibre optic (ST-connector) / IEC 60870-5-103 or Modbus RTU



¹⁾ These binary inputs may be used from 110/125V & 220/250V via external dropper resistors, order combination of the following resistor boxes to suit number of binary inputs.

2512H10064 (9 inputs, 110/125V)

2512H10065 (5 inputs, 110/125V)

2512H10066 (1 inputs, 110/125V)

220/250 V application, order resistor box 2512H10066 in addition

2512H10067 (5 inputs, 220/250V)

2512H10068 (1 inputs, 220/250V)

²⁾ Additional input/output modules must not exceed available module positions.

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