Reyrolle
Protection
Devices

7SG22 Iota

Programmable Logic Module

Answers for energy

SIEMENS

Contents

Technical Manual Chapters

7SG22 Iota

Input / Output Units

Document Release History

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Contents

1. General

The Iota range of relays are a common services module using Programmable logic and designed for application within the substation environment. The relays consist of status inputs and output relays that can be interconnected using logical elements such as AND, OR, NOT gates, pickup/drop-off timers, counters and latches. The relay can accommodate up to 56 input/output points consisting of a combination of 3, 11, 19 or 27 status inputs together with 5, 13, 21 or 29 output relays. 16 or 32 user definable LED's are available to the logic scheme for local indication of functions. The relays features are supplemented by control, instrumentation, data storage and fibre optic data communication capabilities.

Supervisory components and self-monitoring features give a high confidence of full serviceability. A menu-based interface facilitates user friendly access to relay settings, instruments and stored fault data.

The relay can be easily incorporated into substation control and automation systems.

2. ReyLogiC Functions

ReyLogiC is a Windows based schematic capture program used for creating configuration logic diagrams. The inputs and outputs may be interconnected with upto 64 timers, 64 counters and 64 latches along with combinational logic consisting of AND, OR , XOR and NOT gates limited only by the choice of scan rate for the logic. The default scan rate is 1 millisecond but this can be increased to accommodate more complex logic schemes.

3. Output Contacts

The basic IOTA relay provides 5 output relays, three of which energise changeover contacts, the remaining two energise normally open contacts. The number of output contacts can be increased by groups of 8 or 16, to give a maximum of 29 output contacts.

Outputs are user programmable to operate from any or all of the output connections shown on the ReyLogiC scheme. In addition they can be programmed to generate outputs for the relay fail alarm condition.

In their normal mode of operation, output contacts remain energised for at least 100ms. Alternatively, outputs can be programmed to operate as hand reset latching contacts if required. Latched output relays can be reset either by pressing the TEST/RESET button, or by sending an appropriate data communications command.

4. Status Inputs

There are 3 plant status inputs provided in the basic relay, this can be increased in groups of 8 or 16, using additional modules to give a maximum of 27 inputs. The inputs can be mapped to the user defined inputs shown in the ReyLogiC scheme. Each input can be set for high speed or standard operation via a DIL switch mounted on the PCB.

5. Multiple Setting Groups

IOTA relays provide two alternative settings groups, making it possible to edit one group while the relay protection algorithms operate using another 'active' group. The relay can be switched from one group of settings to another to suit alterations to the system configuration. The settings change takes about 2s to switch between groups, during this time the output contacts are held in the previous state until the settings have changed. If the contact state has changed with the new settings they will switch over at the end of the change period when the new group becomes "active".

A change of group can be achieved either locally at the relay fascia or remotely via a communications interface.

All Settings are stored in non-volatile memory.

6. Instrumentation

The IOTA Instrumentation features provide continuous data accessed either from the relay fascia in "**Instruments Display Mode**" or via the data communications interface. While in the display mode pressing the ⇩ key accesses the following data:

Indications showing the condition of the status input signals and the output contacts are available. Where the display indicates a **I** then that position is shown to be active.

The ReyLogiC script name and script description of the stored file are also displayed.

The current count value of any Reylogic counters can be viewed.

The time and date is also displayed. Where appropriate additional displays are available with digital data storage records and event records held.

7. Data Storage

Data records are available in two forms, namely input/output waveform records and event records. All records are stamped with time and date. IOTA incorporates a real time clock feature which keeps time even when the relay is de-energised.

Time and date can be set either via the relay fascia using appropriate commands in the System Configuration Menu, or via the communications interface. In the latter case, relays in a communications network can be synchronised by a global command. Alternatively, time can be synchronised via the IRIG B-12x interface in the relay.

Records are stored in RAM with a capacitor providing back-up during breaks in auxiliary supply.

The internal clock and data record storage features will be maintained for typically 10 days after the removal of the supply.

The records can only be examined once they have been downloaded into a suitable data analysis package such as Reydisp Evolution or by interrogation by the SCADA system.

Waveform Records
The waveform record feature stores digital information for all status inputs and output relays. Waveform storage can be triggered by operation of any status input set to do so in the status configuration menu.

In addition, the waveform records can be triggered remotely via the serial communications interface. Waveforms are stored in a 1 second, rolling 'time window'. The memory is configured for 10 x 1s records. Records of different duration can be requested as a special function. The pre-trigger can be set in 10% steps over the record length.

Any new record over-writes the oldest when the data memory is full. All records are time and date stamped.

Event Records
The event recorder feature allows the time tagging of any change of state of the relay. Each event is logged with the full date and time and actual event condition every 2.5ms. The following events are logged:-

- Change of setting (though not the actual setting changes). Also indication of which group of settings is active.
- Change of state of Output Relays
- Change of state of Status Inputs
- Reset

The event storage buffer holds at least 500 records. When the event buffer is full, then any new record over-writes the oldest.

8. Communications

A front mounted RS232 port and two rear fibre optic communication ports are provided.

Communication is compatible with the IEC60870-5-103 transmission and application standards. The fibre optic interface gives superior EMC performance. A user friendly software package (Reydisp Evolution) is available to allow transfer of the following:

- Relay settings
- Waveform records
- Event records
- Instruments
- Control Functions

Communications operation is described in detail in the Reyrolle Informative Communication Interface Manual.

9. Self Monitoring

The IOTA incorporates a number of self-monitoring features. Each of these initiates a reset sequence, which can be used to generate an alarm output. In addition, the Protection Healthy LED gives visual indication.

A watchdog feature monitors the microprocessor while the relay has a self-check feature for the program memory, which is continuously checked for data corruption.

The power supply is continuously supervised. Any failure is detected with sufficient time warning so that the microprocessor can be shut down in a safe and controlled manner.

10. Password Feature

The programmable password feature enables the user to enter a 4 character alpha-numeric code. The relay is supplied with the password function disabled. To enable the password feature the user must first enter a password. Verification of this is asked for and then this becomes the valid password.

As soon as the user attempts to change a setting or download new logic script the password is requested before any setting alterations are allowed. Once the password has been validated, the user is said to be "logged on" and any further changes can be made without re-entering the password. If no more changes are made within 1 hour then the user will automatically be "logged out", re-enabling the password feature.

Note that the password validation screen also displays a numerical code. If the password is lost or forgotten, this code can be communicated to Reyrolle Protection by authorised personnel, and the password can be retrieved.

The relay is supplied with the password set to "**NONE**" which means the feature is de-activated.

To de-activate the password change the password to "**NONE**" the function will now be disabled.

Reyfresh - Upgradeable Software

This allows the user a method of upgrading the software without having to dismantle the product to enhance its capabilities. New or updated software can be downloaded via the comms. ports.

ReyLogiC Scheme Logic

This is a Windows based programme and allows a logic diagram which can contain I/O, logic gates, timers, counters and latching elements to be downloaded from a PC to the relay.

11. User Interface

The user interface is designed to provide a user-friendly method of entering settings and retrieving data from the relay. The HMI is shown in figure 1.

General Arrangement
All IOTA relay fascias include a liquid crystal display, 17 or 33 light emitting diodes, 5 push buttons and an RS232 data communications socket.

The LCD has a 20 character by 2 line display which is backlit.

Liquid Crystal Display
The liquid crystal display is used to present settings, instruments and fault data in a textual or graphical format.

The display back lighting is turned off to conserve power if no pushbuttons are pressed for 5 minutes. After an hour, the whole display is de-activated, except in the instruments mode, which will remain visible permanently.

LED Indications
The following indications are provided:

Protection Healthy - Green LED.

This LED indicates that DC volts have been applied to the relay and that the relay is operating correctly. If a permanent fault is detected by the internal supervision, then this LED will continuously flash.

Red LED

These LED's indicate that an operation as defined by customer setting has occurred. All red LED's are user programmable and can be assigned to any ReyLogiC output function. The legends for the LED's are inserted into pockets on the rear of the front label. A maximum of 24 characters is available per legend.

Keypad
Five push buttons are used to control the functions of the relay by moving around the menu display. They are labelled ⇩ ⇧ ⇨ **ENTER** and **CANCEL**. Note that the ⇨ button is also labelled **TEST/RESET**.

Only two push buttons are accessible when the front cover is on. These are the ⇩ and ⇨ buttons, allowing read only access to all displays.

12. Settings and Displays

The basic settings/displays flow diagram is shown below. This diagram shows the two main modes of display, the SETTINGS DISPLAY MODE and the INSTRUMENT DISPLAY MODE.

On relay start up, the user is presented with a default relay identifier and the script name of the current logic file. This can be changed (In the SYSTEM CONFIG MENU) to some user-definable identifier or code if the user prefers.

Settings display mode is entered by scrolling down from the relay identifier display. The ⇨ key can then be used to move to the INSTRUMENT DISPLAY MODES.

The settings display mode contains all the menus, which hold the programmable settings of the relay. It contains a series of sub-menus with title displays as follows:

SYSTEM CONFIG MENU
⇨ TO VIEW

STATUS CONFIG MENU
⇨ TO VIEW

REYLOGIC CONFIG MENU
⇨ TO VIEW

OUTPUT RELAY CONFIG MENU
⇨ TO VIEW

LED CONFIG MENU
⇨ TO VIEW

DATA STORAGE MENU
⇨ TO VIEW

COMMUNICATIONS MENU
⇨ TO VIEW

A sub-menu is opened by pressing the ⇨ key when viewing one of the above title screens. The settings within the sub-menu can then be viewed in turn. Leaving a sub-menu, by scrolling either upwards or downwards, causes it to be automatically closed. It must be re-opened in order to view its settings again.

(1) Pressing ⇧ / ⇩ scrolls up / down, viewing the screens. All screens can be viewed even if the password is not known - the password only protects the relay against unauthorised changes.

(2) While viewing an editable screen, **ENTER** allows the user to change the displayed data, indicated by flashing character, as long as the changes are authorised via password verification. Pressing ⇧ / ⇩ increments / decrements that particular character, while ⇨ moves right along the edit field or fields. If ⇧ or ⇩ are held pressed while scrolling through a range of numerical settings then the rate of scrolling increases.

CANCEL returns the screen to view mode and restores the most recently stored setting.

(3) If changes are made, pressing **ENTER** alters the values on that screen and **immediately** stores the changes into non-volatile memory. This also returns the screen to view mode and allows ⇧ / ⇩ to move to the previous / next screen.

There are two separate 'Settings Groups'. The different settings groups can be viewed or edited independently and indication of which group is presently being viewed is given by the 'G?' character in the top left of the display.

The setting selections, setting ranges and default values can be found in the relay settings section of the technical manual.

13. Relay Hardware

The range of IOTA relays are housed in the Epsilon case - size 8 or 12.

The IOTA relay hardware is illustrated in Diagrams section 9 of this manual.

Internal Construction
The build consists of up to 6 internal hardware modules as well as the fascia module. All IOTA relays are supplied with the following modules:

Module A Power supply + basic I/O

Module F Protection processor and controller

Modules B, C, D and E are optional giving additional input/output capability.

The fascia PCB includes the human machine interface (HMI), with pushbuttons for entering settings, an LCD for displaying alphanumeric and optionally graphical information and LEDs for indication. A 25 pin RS232 D type connector is located on the front plate to allow local data communications.

Two remote data communications interfaces - fibre optic - and an IRIG-B connector are located behind module F and connected into the controller card.

A 34 way ribbon cable connects the I/O and fascia modules to the processing and protection processor /controller modules.

The design for the internal arrangement of each module has been chosen to provide a high level of EMI screening, using multi-layer PCBs with ground planes, RFI suppression components and earthed metal screens.

The case is segregated internally into electrically noisy and quiet areas in order to improve noise immunity and reduce RFI emissions. The only direct connection from the quiet components to the external environment is via the serial communication interfaces. The optical interfaces are immune to radiated or conducted interference.

Front Cover
After the relay has been commissioned, a clear plastic front cover is fitted. This allows the user to see the entire front of the relay, but only allows access to the ⇩ and ⇨ buttons, allowing all of the menus discussed previously to be viewed but not changed. The only 'action', which is permitted, is to reset the latched output relays and indications by using the **TEST/RESET** function of the ⇨ button.

Terminal Blocks
These are of the standard Epsilon design with 28 terminals per block. All inputs and outputs (except for the serial communications interface) are made through these connectors. On the control card all normally closed output contacts are fitted the terminals are provided with shorting contacts to provide system integrity when these modules are removed.

7SG22 Iota

Input / Output Units

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Contents

1 General

Performance Data to:
IEC60255-6, IEC60255-6A and IEC60255-16.

2 Auxiliary Energizing Quantity

2.1 DC Power Supply

	Nominal	Operating Range
VAUX	50/110/125V	37.5V to 137.5V dc
VAUX	220/250/260V	175V to 286V dc

2.2 DC Status Inputs

Nominal Voltage	Operating Range
30/34	18V to 37.5V
48/54	37.5V to 60V
110/125	87.5V to 137.5V
220/250	175 to 286V

Status Input Performance (30V and 48V)

Minimum DC current for operation	10mA
Reset/Operate Voltage Ratio	≥ 90%

Status Input Performance (110V and 220V)

Minimum DC current for operation	1mA
Reset/Operate Voltage Ratio	≥ 90%

NB Status operating voltage need not be the same as the main energising voltage. 48/54 volt rated status inputs can be supplied with external dropper resistors, for use with 110V or 220V dc supplies, as follows:-

Status Input External Resistances

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

Two types of status inputs are provided, and can be set by operation of DIL switch viz:-

a) High speed status inputs.

Typical response time	<5ms
Typical drop off time	<5ms
Typical response time when programmed to energise an output relay contact	<10ms

b) Scheme status inputs. These status inputs will not respond to either 250V RMS 50/60 Hz applied for 1 second or to the discharge of a 10µF capacitor charged to maximum DC auxiliary supply voltage.

Typical response time	<25ms
Typical Drop off time	<25ms
Typical response time when programmed to energise an output relay contact	<30ms

3 Accuracy

3.1 Accuracy Influencing Factors

Temperature

Ambient range	-10°C to +55°C

Variation over range	≤ 5%

Auxiliary DC Supply – IEC 60255-11

Allowable superimposed ac component	≤ 12% of DC voltage
Allowable breaks/dips in supply (collapse to zero from nominal voltage)	≤ 20ms

4 Burdens

4.1 D.C. Burden

	DC Burden (watts)
Quiescent (Typical)	15
Max	27

5 Output Contact Performance

Contact rating to IEC 60255-0-2.

Carry continuously 5A ac or dc

Make and Carry
(limit L/R ≤ 40ms and V ≤ 300 volts)

for 0.5 sec	20A ac or dc
for 0.2 sec	30A ac or dc

Break
(limit ≤ 5A or ≤ 300 volts)

ac resistive	1250VA
ac inductive	250VA @ PF ≤ 0.4
dc resistive	75W
dc inductive	30W @ L/R ≤ 40 ms 50W @ L/R ≤ 10 ms

Minimum number of operations	1000 at maximum load
Minimum recommended load	0.5W, limits 10mA or 5V

6 Environmental Withstand

Temperature - IEC 6068-2-1/2

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

Humidity - IEC 6068-2-3

Operational test	56 days at 40°C and 95% RH

Transient Overvoltage –IEC 60255-5

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

Insulation - IEC 60255-5

Between all terminals and earth	2.0kV rms for 1 min

Between independent circuits	2.0kV rms for 1 min
Across normally open contacts	1.0kV rms for 1 min

High Frequency Disturbance - IEC 60255-22-1 Class III

	Variation
2.5kV Common (Longitudinal) Mode	≤ 3%
1.0kV Series (Transverse) Mode	≤ 3%

Electrostatic Discharge - IEC 60255-22-2 Class IV

	Variation
8kV contact discharge	≤ 5%

Conducted & Radiated Emissions - EN 55022 Class A

Conducted	0.15MHz to 30MHz
Radiated	30MHz to 1000MHz

Conducted Immunity - IEC 60255-22-6 Class A

0.15MHz to 80MHz, 10V/m 80% Modulated

Radiated Immunity - IEC 60255-22-3 Class III

	Variation
80MHz to 1000MHz, 10V/m 80% Modulated	≤ 5%

Fast Transient – IEC 60255-22-4 Class IV

	Variation
4kV 5/50ns 2.5kHz repetitive	≤ 3%

Surge Impulse –IEC61000-4-5 Class IV

	Variation
4kV Line-Earth	≤ 10%
2kV Line-Line	≤ 10%

Vibration (Sinusoidal) –IEC 60255-21-1 Class 1

		Variation
Vibration response	0.5gn	≤ 5%
Vibration endurance	1.0gn	≤ 5%

Shock and Bump–IEC 60255-21-2 Class 1

		Variation
Shock response	5 gn 11ms	≤ 5%
Shock withstand	15 gn 11ms	≤ 5%
Bump test	10 gn 16ms	≤ 5%

Seismic – IEC 60255-21-3 Class 1

		Variation
Seismic Response	1gn	≤ 5%

Mechanical Classification

Durability	In excess of 10^6 operations

7SG22 Iota

Input / Output Units

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Contents

1 System Configuration Menu

Description	Range	Default
Active Setting Group	1, 2	1
View/Edit Group	1, 2	1
Date	Day/Month/Year	1/1/1998
Time	Hrs:Min:Sec	00:00:00
Change Password	AAAA…ZZZZ	NONE
Relay Identifier	Upto 16 characters	IOTA

2 Status Configuration

Description	Range	Default
Input Matrix Tag Name	NONE, 1…27	NONE
Trigger Storage	NONE, 1…27	NONE

3 Reylogic Configuration – Scheme Name

Description	Range	Default
Counter -Scheme Dependant	1 … 999 step 1 1000 … 10000 step 10 10000 … 60000 step 100	1
Pick up Delay – per timer Scheme Dependant	0 … 999 ms step 1ms 1 … 9.9s step 10ms 10 …60s step 100ms	0
Drop off Delay – per timer Scheme Dependant	0 … 999 ms step 1ms 1 … 9.9s step 10ms 10 …60s step 100ms	0

4 Output Configuration

Description	Range	Default
Output Matrix Tag Names	NONE, 1…29	NONE
Protection Healthy	NONE, 1…29	NONE
Hand Reset Relays	NONE, 1…29	NONE

5 Led Configuration

Description	Range	Default
Output Matrix Tag Names	NONE, 1…16/32	NONE
Self Reset LED's	NONE, 1…16/32	NONE

6 Data Storage Menu

Description	Range	Default
Pre-Trigger Storage	0…100 % STEP 10%	20 %
Data Record Duration	10Recs x 1Second 5Recs x 2Second 2Recs x 5Second 1Recs x 10Second	10Recs x 1Second

4 Communications Menu

Description	Range	Default
Station Address	0…254	0
IEC870 On Port	Com1, Com2	Com1
Com1 Baud Rate	75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
Com1 Parity	Even, Odd, None	Even
Com1 Line Idle	Light Off, Light On	Light Off
Com1 Data Echo	Off, On	Off
Com2 Baud Rate	75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200
Com2 Parity	Even, Odd, None	Even
Com2 Line Idle	Light Off, Light On	Light Off
Com2 Data Echo	Off, On	Off
Com2 Direction	Auto-Detect, Rear Port, Front Port	Auto-Detect

APPENDIX A

Settings Walkthrough

The relay displays are organised into three lists:-

A list of settings
A list of instruments
A list of fault records

This walkthrough describes the settings and is intended to be read in front of a powered-up relay.
The starting point is the relay identifier screen. This is the screen the relay displays when it is first powered-up and can be reached from any display by pressing CANCEL.

From this position press the down arrow key ⇩ once, the relay will display “SETTINGS MODE”. From this display the down arrow key ⇩ can be pressed again to enter the setting list, or the right arrow key ⇨ can be pressed to choose a different list (“INSTRUMENTS MODE”). Press the down arrow key ⇩. The relay enters the settings list and displays “SYSTEM CONFIG MENU”.

SYSTEM CONFIG MENU

This menu contains general settings which allows the relay to be configured. Press ⇨ to open the menu and display the settings.

Active Group

There are 2 setting groups in the relay. Some settings can have different values in each group while others have the same value in all groups. This setting controls which group of values is applied to the relay. When it is changed all the settings which can have different values in each group are changed.

View/Edit Group

Each setting group can be viewed and edited without making it active. Settings that can be different in each group indicate which group the displayed value belongs to with the letter “G” and the group number in front of the setting description. This setting controls which group is displayed.

IMPORTANT: whichever group of settings are visible may **NOT** be the settings the relay is using. The relay will only operate on the **Active Group** regardless of the displayed settings.

Date

The current date is set in this menu. The format is DD,MM,YYYY

Time

The current time is set. In this menu only minutes and hours are set. The format is HH,MM the 24 hour clock is used.

Change Password

The relay is provided with a password feature. If set it will prevent any un-authorised changes to any of the relay settings. The password is a four character word once set it can be disabled by entering the new password NONE.
Note that the password validation screen also displays a numerical code. If the password is lost or forgotten, this code can be communicated to Reyrolle Protection by authorised personnel, and the password can be retrieved.

Relay Identifier

The relay is supplied with a default identifier usually the relay model. This can be changed to give any

meaningful identification to the relay. eg feeder name or circuit number.

This is the last setting in this menu. Press ⇩ to display the next menu.

STATUS CONFIG MENU

The number of status inputs can vary with the relay model type. Each of the status inputs can be mapped to any one or more of the Reylogic inputs. The tag names allocated to the inputs on the ReyLogiC scheme appear in this menu.

Trigger Storage

An external device can be used to trigger the waveform storage through this input

REYLOGIC CONFIG MENU

Settings of functions that have been configured in ReyLogiC, and have been configured to be visible settings, are found in this menu.
i.e. Counters and timers

OUTPUT CONFIG MENU

Depending upon the configuration of the ReyLogiC within the relay there are a large number of signals, which can be mapped to output contacts. Every output connection on the Reylogic scheme can be selected to appear in this menu and mapped to one or more of the output relays. All outputs are listed by their 'tag name' which can be modified in ReyLogiC. All output relays are self reset unless selected to be hand reset in this menu**.**

Protection Healthy

This output monitors the condition of the relay and dc power to the relay. This must be mapped to one of the outputs, which have a normally closed contact. When this function is selected it will permanently operate the selected relay. By using a normally closed contact if there is any failure then this contact will close giving a fail safe alarm condition.

LED CONFIGURATION MENU

With the exception of the "Protection Healthy" item, this menu has the same outputs as the
Output Configuration menu and these can be used to energise any of the LED flags.
All LED's are hand reset unless set to be self reset in this menu. If LED's are changed to be hand reset the TEST/RESET button must be pressed on completion of the setting modification.

7SG22 Iota

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1. Reylogic

The purpose of ReyLogiC is to enable a high degree of flexibility within a relay. It allows elements within the relay to be interconnected with combinational logic, timers, counters and latches.

All timers and counters entered on a schematic diagram can be set within ReyLogiC to have a fixed setting which can only be modified from the ReyLogiC diagram editor or a visible setting which appears in the normal settings list to allow on site modifications without having to use a PC to modify schematics. All Boolean points marked as inputs on the schematic package appear in the settings lists by means of their 'tag name' with a matrix setting which allows that input to be driven from any of the status inputs. All Boolean points marked on the schematic package as outputs appear in the settings list by means of their 'tag name' with a matrix setting which allows any combination of output relays and fascia flags to be selected.

ReyLogiC is a Windows based schematic capture program which allows the manufacturer or a customer to enter a logical diagram using any number of logic elements which expresses the configuration of a particular function. The primary output of the package is a set of Boolean logic equations which can be downloaded into the relay. Other features include :-

- Loading and Saving of logic schematics
- Printing of logic schematics
- Generation of logic equations from schematics
- Printing of logic equations
- Connection to relay and download of schemes to relay.
- Cutting and Pasting to other windows applications for documentation purposes.
- Project management facilities for grouping logic diagrams as an overall assembly for download to relay along with supplemental files specifying default configurations for status input marshalling, output relay marshalling, IEC870 event codes etc.

Logic scripts are down loaded from the PC over the serial communications port using an ASCII protocol, each character received by the relay is echoed back to the PC to confirm correct transmission. If the logic script is not successfully transmitted the script will not be used by the relay.
The unit will attempt to run the last logic script to be loaded. To make a new logic script active following down loading the relay must be 'cold started', this mechanism is part of the ReyLogiC application after successful logic scheme transfer.
If the latest logic script is found to be invalid, or the unit has no logic scripts loaded when it is powered up the LCD will display 'NO LOGIC'
.

The following block diagram shows the logic execution engine for the IOTA.

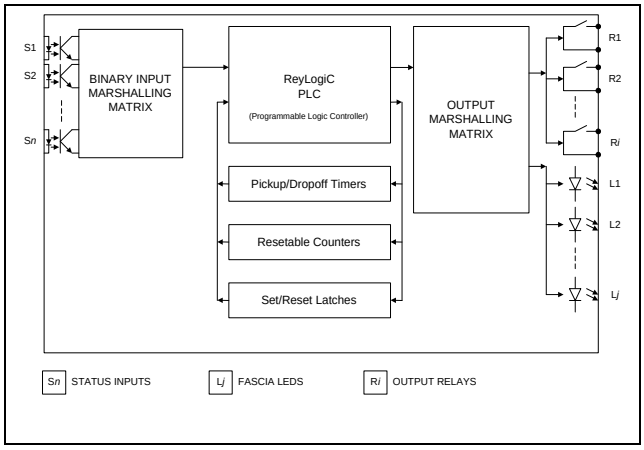
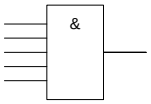


Figure 1: IED Block Diagram

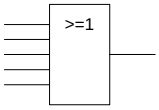
Logic Schematics Elements

.1. AND Gates



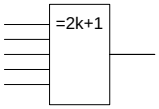
This is a multi-input logical AND gate. It takes as inputs the Boolean conditions which are wired to the inputs and outputs a Boolean which is the logical "AND". If all inputs are TRUE (Logical 1) then the output will be TRUE otherwise the output will be FALSE (Logical 0).
The number of inputs to each gate is adjustable upto 16 inputs.

.2. OR Gates



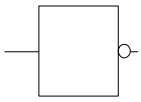
This is a multi-input logical OR gate. It takes as inputs the Boolean conditions which are wired to the inputs and outputs a Boolean which is the logical "OR". If one or more of the inputs is TRUE (Logical 1) then the output will be TRUE otherwise the output will be FALSE (Logical 0).
The number of inputs to each gate is adjustable upto 16 inputs.

.3. XOR Gates



This is a double input logical XOR gate. It takes as inputs the Boolean conditions which are wired to the inputs and outputs a Boolean which is the logical "XOR". If only one of the inputs is TRUE (Logical 1) then the output will be TRUE otherwise (both inputs TRUE or both inputs FALSE) the output will be FALSE (Logical 0).

.4. NOT Gates

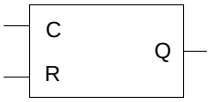


This is a single-input NOT gate. The output Boolean condition is the logical NOT of the input Boolean. If the input is TRUE (Logical 1) then the output will be FALSE (Logical 0). If the input is FALSE (Logical 0) then the output will be TRUE (Logical 1).

.5. Pickup / Drop off Timers

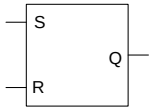
If the Boolean input remains TRUE for the entire PICK-UP time, the output Boolean will then also be set to TRUE. The output Boolean will remain TRUE as long as the Input Boolean also remains TRUE. When the input Boolean is set FALSE then the Output Boolean will also be set FALSE when the DROP-OFF timer expires.

.6. Resetable Counters



The resetable counters may be used to count discrete events. Every time the INPUT (C) transitions from a FALSE to a TRUE logical state the counter is incremented. When the specified terminal count is reached the OUTPUT is set to logical TRUE. If the RESET input becomes logically TRUE then the counter is zeroed and the OUTPUT is set FALSE and will remain held in this state until the RESET input condition reverts to FALSE.

.7. Set/Reset Latches



When the SET (S) input alone is logically TRUE then the OUTPUT (Q) is set logically TRUE. If the RESET (R) input is TRUE then the output will always be FALSE.

.8. Inputs

Boolean inputs to the logic system may belong to the output from another logic diagram or may be connected to a status input via the marshalling matrix. The ‘tag name’ given to the input on the ReyLogic diagram is used as the identification label found in the status input configuration menu.

.9. Outputs

Boolean outputs from the logic system may be an input to another logic diagram or may be connected to the output relay or fascia LED’s via a marshalling matrix. The ‘tag name’ given to the output on the ReyLogic diagram is used as the identification label found in the output relay configuration menu.

2. Scheme Design

Reylogic gives the programmer the flexibility to ensure all control requirements are met within the logic scheme e.g. duration of output pulses, double pole inputs and don’t believe it logic.

When using timers consideration must be given to the status input pick up/drop off delay and processing/scanning time of the logic (see Performance Specification).

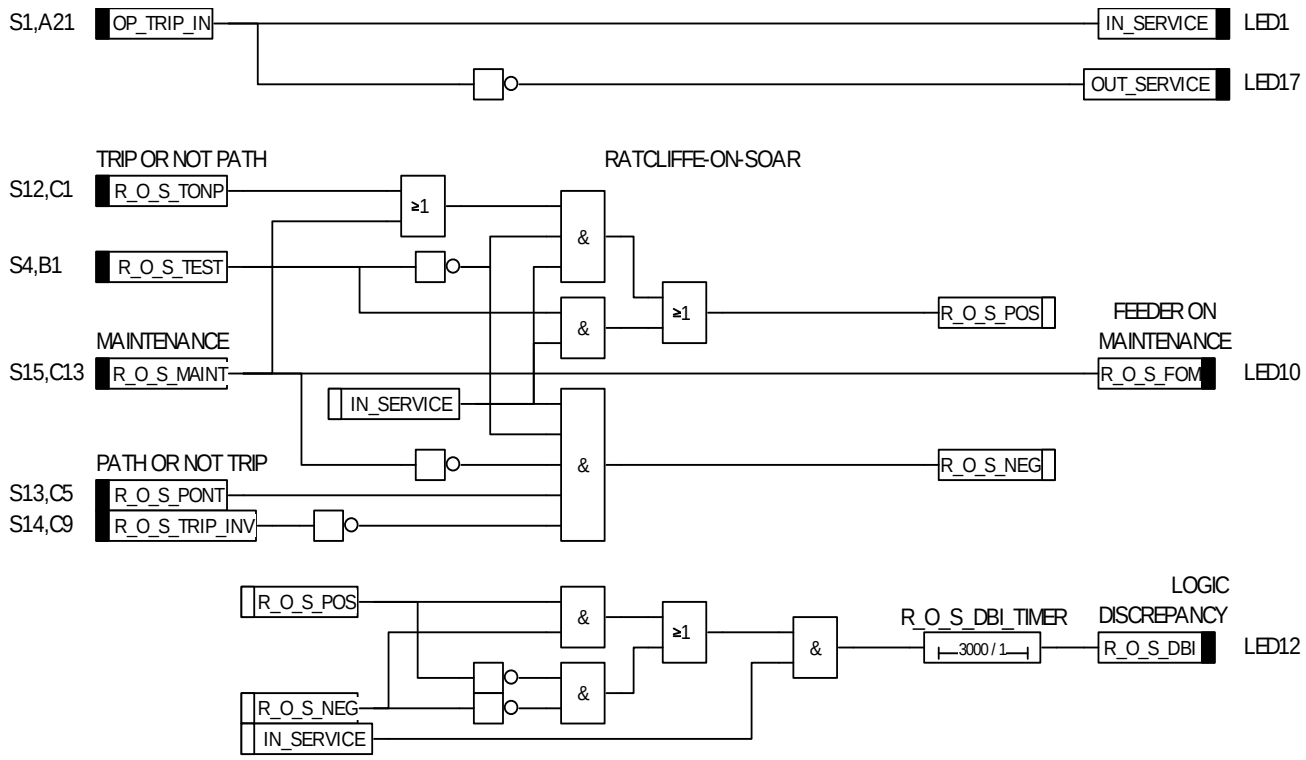


FIGURE 2: TYPICAL EXAMAPLE OF REYLOGIC SCHEME DIAGRAM

7SG22 Iota

Input / Output Units

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This document is issue 2010/02. The list of revisions up to and including this issue is:

Pre release

2010/02	Document reformat due to rebrand

Software Revision History

Contents

1 Introduction

The IOTA relay has provision for communication either locally to a computer or remotely to an operations centre.

The Communication Interface, figure 1, incorporates the following ports:

A pair of fibre optic SMA connectors for transmit and receive communications to a substation SCADA or integrated control system or for downloading files (Com 1 or Com 2).

A pair of fibre optic SMA connectors for access by protection engineers (Com 2b). The same port can be accessed instead through an RS232 (Com 2a) connector mounted on the relay fascia and provides facilities for access to the relay from a laptop computer or PC.

The relay will support both IEC60870-5-103 and ASCII protocols.
The IEC60870-5-103 standard protocol can be set

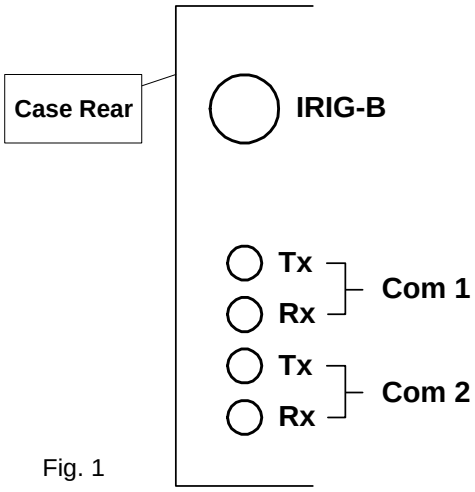

Fig. 1

to operate on either com port 1 or 2, with the other port defaulting to ASCII protocol, and is used by the relay for the transfer of data and is fully described in the Reyrolle document "**Informative Communication Interface".**
The ASCII protocol is used for the transfer of ReyLogic script files from a PC to the relay.
An IRIG-B port is also provided for time synchronisation.

The Sigma range of products are available to connect to the fibre optic ports of the relays.

Sigma 1 is a fibre optic hub with one system port and up to 29 ports for connecting to the relays.

Sigma 3 is a fibre optic to dual RS232 interface. It has one fibre optic port for connection to the relay(s), and two electrical RS232 ports. The rear electrical port is intended for connection to a control system. The front port allows local access, for example, from a laptop PC. When a device is connected to the front port the rear port is overridden. Figure 2.

Sigma 4 is a portable fibre optic to RS232 conversion unit available in two versions – 'polymer and glass'.

2 Connections

3.1 Physical Characteristics

The IOTA relays are equipped with two fibre-optic, and one electrical serial communication ports. The fibre optic ports named Com 1 and Com2 are located at the rear of the relay. Each consists of a pair of 9mm SMA connectors, a transmitter (Tx) and a receiver (Rx). See figure 1.

The RS232 electrical port is on the front of the relay. It uses a 25 pin D type socket. The relay is wired as a Data Communications Equipment (DCE) device, allowing standard serial cables to be used to connect it to a computer. The electrical port is also named Com2, allowing local access overriding the fibre-optic Com 2.

3.2 Fibre Optic Cable

The IOTA relay is optimised to use either a 50/125 μm or 62.5/125 μm glass fibre optic cable. It is also suitable for use with 1mm polymer and 200PCS fibre optic cables over shorter distances.

Fibre-optic transmission distances vary with transmitter, receiver and type of fibre. The tables at the end of this section show the achievable distances between Reyrolle devices.

3.3 Connection Methods

The fibre-optic ports of the relay are intended for connection to a master station or an adjacent relay either using a 'star' or 'ring' configuration. The "Transmit" output on the IOTA must be connected to the "Receive" input of the next device, the "Receive" input on the IOTA must be connected to the "Transmit" output of the previous device, see figures 2, 3 & 4 attached to the end of this section.

The fibre-optic ports may be used to build a ring network of relays, see figure 2. If a ring is not considered to have sufficient security a Sigma 1 can be utilised to create a star network, see figure 3.

Remote Dial-Up can be achieved with the use of telephone modems, see figure 4. More information on connecting using telephone modems is given in the document **434/TIR/007 Remote Communications**.

Connection to the electrical port is via a standard modem cable.

3 Relay Settings

3.1 Transmission Methods

Half duplex serial asynchronous transmission.

3.2 Communications Menu

The relay communications are set-up by accessing the 'configuration/communications' menu of the relay. The settings on the relay should be matched to the settings on the master station. The settings for Com 2 apply to both the fibre-optic and electrical ports.

3.3 Station Address

Sets the unique address given to the relay to allow communications. The valid addresses are 1 to 254, allowing 254 devices on a network. Address 0 switches communications to the relay off.

3.4 IEC60870 on Port

Sets the port the IEC60870-5-103 protocol should operate on, either COM1 or COM2.

3.5 Com 1 Baud Rate and Com 2 Baud Rate

Sets the rate the respective port will operate at in bits per second. Options are 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200.

3.6 Com 1 Parity and Com 2 Parity

Sets the parity used by the port. Options are None, Even and Odd.

Default – Even

3.7 Com 1 Line Idle and Com 2 Line Idle

Sets the line idle state used by the port. Options **light off** and **light on**. IEC60870-5-103 defines the line idle state as light on. However, some hardware may not be able to produce this so an option to switch to **light off** is provided. The sigma units 1 & 3 contain switches to switch between Light off and Light On. On Sigma 4 this is achieved with a jumper connection, jumper OFF is **light off**. This setting has no effect on the electrical Com 2 port.

3.8 Com 1 Data Echo and Com 2 Data Echo

When the relays are connected in a ring this setting should be **on**, enabling data to be echoed from one relay to the next. Otherwise it should be **off** to reduce the communications overhead.

3.9 Com 2 Direction

This setting effects how the Com 2 ports, fibre optic or electrical are used. Options are **Auto-Detect**, **Rear Port** and **Front Port**. Auto-Detect automatically switches to the front port when a device is plugged into it, reverting to the rear when the device is removed. The Rear Port and Front Port settings explicitly set which port is active. If you try to communicate with a port when the other is active no communication will take place.

4 Fibre-optic distances

These figures are maximum distances based on manufacturers' data and may be subject to change without notice. No account is taken of minimum distances. With certain fibres with short distances and high transmitting powers, it is possible to overload the receivers thus causing errors. Full data for transmit and receive powers is available on request. All distances are in metres, and are maximum figures, allowing for LED degradation.

NOTE: IOTA is a Modular II relay.

1mm polymer

SOURCE	DESTINATION							
	Argus	Modular I	Modular II	Sigma 1	Sigma 3	Sigma 4p	Sigma 4g	Honeywell
Argus	40	0	70	70	40	80	80	130
Modular I	0	5.5	0	0	3.5	6.0	6.0	13.5
Modular II	4.5	0	6.5	6.5	4.5	7.0	6.0	14.5
Sigma 1	4.5	0	6.5	6.5	4.5	7.0	7.0	14.5
Sigma 3	10.0	35	35	35	10.0	45	45	35
Sigma 4p	38	65	65	65	35	75	75	125
Sigma 4g	2.5	4.5	4.5	4.5	2.5	5.0	5.0	12.5
Honeywell	5.0	7.0	7.0	7.0	5.0	7.5	7.5	15.0

200µm PCS

SOURCE	DESTINATION							
	Argus	Modular I	Modular II	Sigma 1	Sigma 3	Sigma 4p	Sigma 4g	Honeywell
Argus	100	0	260	260	100	320	320	620
Modular I	0	1320	0	0	750	1520	1520	3610
Modular II	1540	0	2110	2110	1540	2310	2310	4400
Sigma 1	1540	0	2110	2110	1540	2310	2310	4400
Sigma 3	0	0	0	0	0	0	0	250
Sigma 4p	0	0	0	0	0	0	0	250
Sigma 4g	370	940	940	940	370	1140	1140	3230
Honeywell	1290	1860	1860	1860	1290	2060	2060	4140

62.5/125 µm glass

SOURCE	DESTINATION							
	Argus	Modular I	Modular II	Sigma 1	Sigma 3	Sigma 4p	Sigma 4g	Honeywell
Argus	0	0	0	0	0	0	0	40
Modular I	0	350	0	0	0	850	850	6070
Modular II	350	0	1780	1780	350	2280	2280	7500
Sigma 1	350	0	1780	1780	350	2280	2280	7500
Sigma 3	0	0	0	0	0	0	0	0
Sigma 4p	0	0	0	0	0	0	0	0
Sigma 4g	0	0	0	0	0	0	0	4750
Honeywell	0	210	210	210	0	710	710	5930

50/125 µm glass

SOURCE	DESTINATION							
	Argus	Modular I	Modular II	Sigma 1	Sigma 3	Sigma 4p	Sigma 4g	Honeywell
Argus	0	0	0	0	0	0	0	0
Modular I	0	0	0	0	0	0	0	5070
Modular II	0	0	420	420	0	920	920	6140
Sigma 1	0	0	420	420	0	920	920	6140
Sigma 3	0	0	0	0	0	0	0	0
Sigma 4p	0	0	0	0	0	0	0	0
Sigma 4g	0	0	0	0	0	0	0	3510
Honeywell	0	0	0	0	0	0	0	4760

Example:

A ring of relays with a Sigma 4p is required to communicate with a PC. The ring consists of an Argus relay and a Modular II. From the Transmitter of the Sigma 4p to the Receiver of the Argus, using 1mm polymer fibre, the maximum distance is 38m. From the Transmitter of the Argus to the Receiver of the Modular II using 1mm polymer fibre, the maximum distance is 70m. From the Transmitter of the Modular II to the Receiver of the Sigma 4p, the maximum distance is only 7m with 1mm polymer fibre. However, it can be seen from the tables that using an alternative fibre type, maximum distances which can be achieved will vary, for example in the above instance using 200PCS, the maximum distance is extended to 2.3km! (There is a minimum distance associated with this configuration, however, of around 1.5km)

For detail of fibre optic budget loss calculations a copy of 'APPLICATION GUIDE REYROLLE PROTECTION – RELAY COMMUNICATIONS' should be examined.

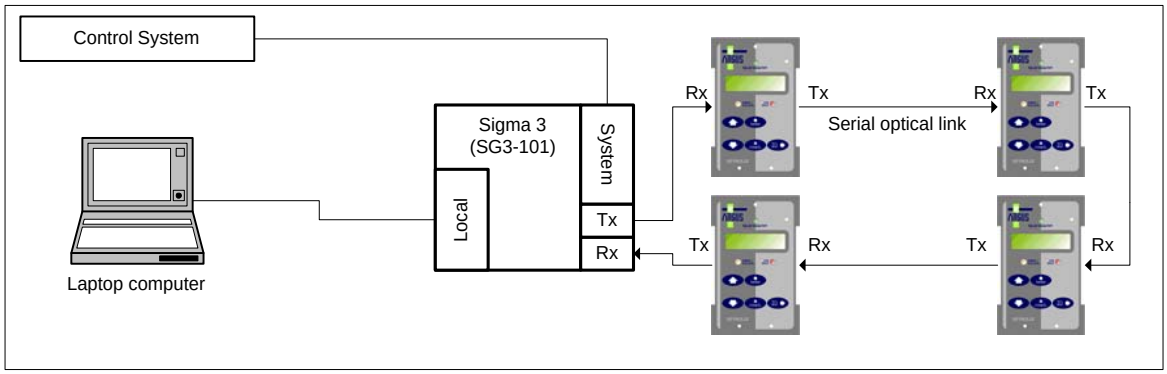

Figure 2 - Fibre Optic Ring Connection using Sigma 3

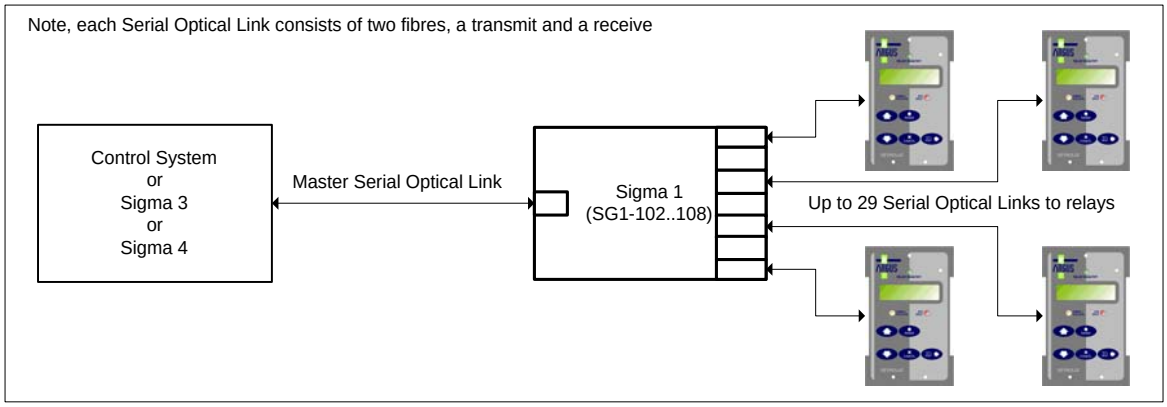

Figure 3 - Fibre Optic Star Connection Using Sigma 1

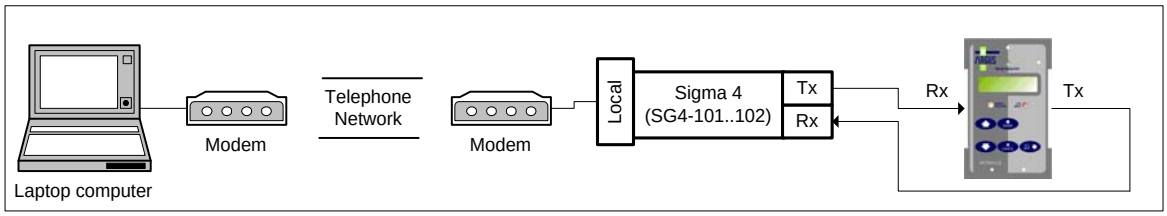

Figure 4 – Remote Dial-Up Connection using Sigma 4

7SG22 Iota

Input / Output Units

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Pre release

2010/02	Document reformat due to rebrand

Software Revision History

Contents

1 Unpacking, Storage and Handling

On receipt, remove the relay from the container in which it was received and inspect it for obvious damage. It is recommended that the relay modules are not removed from the case. To prevent the possible ingress of dirt, the sealed polythene bag should not be opened until the relay is to be used.

If damage has been sustained a claim should immediately be made against the carrier, also inform Reyrolle Protection and the nearest Reyrolle agent.

When not required for immediate use, the relay should be returned to its original carton and stored in a clean, dry place.

The relay contains static sensitive devices, these devices are susceptible to damage due to static discharge and for this reason it is essential that the correct handling procedure is followed.

The relay's electronic circuits are protected from damage by static discharge when the relay is housed in its case. When individual modules are withdrawn from the case, static handling procedures should be observed.

- Before removing the module from its case the operator must first ensure that he is at the same potential as the relay by touching the case.
- The module must not be handled by any of the module terminals on the rear of the chassis.
- Modules must be packed for transport in an anti-static container.
- Ensure that anyone else handling the modules is at the same potential.

As there are no user serviceable parts in any module, there should be no requirement to remove any component parts.

If any component parts have been removed or tampered with, then the guarantee will be invalidated. Reyrolle Protection reserve the right to charge for any subsequent repairs.

2 Recommended Mounting Position

The relay uses a liquid display (LCD) which is used in programming and or operation. The LCD has a viewing angle of ± 45º and is back lit. However, the best viewing position is at eye level, and this is particularly important when using the built-in instrumentation features. For circumstances where the LCD is difficult to read, contrast adjustment is available by pressing the ⇒ (Right/Test/Reset) and the ⇑ (Read Up) or ⇓ (Read Down) buttons together. When the above combination is pressed the backlight is switched on and the contrast level of the screen is cycled until the buttons are released.

The relay should be mounted to allow the operator the best access to the relay functions.

3 Relay Dimensions

The relay is supplied in an Epsilon case size 8 or 12. Diagrams are provided elsewhere in this manual.

4 Fixings

4.1 Crimps

Amp Pidg or Plasti Grip Funnel entry ring tongue or a suitable alternative from another manufacturer.

Size	AMP Ref	Reyrolle Ref
0.25-1.6mm^2	342103	2109E11602
1.0-2.6mm^2	151758	2109E11264

4.2 Panel Fixing Screws

2-Kits – 2995G10046 each comprising:

- Screw M4 X10
  2106F14010 – 4 off
- Lock Washes
  2104F70040 – 4 off
- Nut M4
  2103F11040 – 4 off

4.3 Communications

9mm SMA fibre optic connections – 4 per relay (Refer to section 5 – Communications Interface).

5 Ancillary Equipment

The relay can be interrogated locally or remotely by making connection to the fibre optic terminals on the rear of the relay or the RS232 port on the relay fascia. For local interrogation a portable PC is required. The PC must be capable of running Microsoft Windows Ver 3.1 or greater, and it must have a standard RS232 port. A standard data cable is required to connect from the PC to the 25 pin female D type connector on the front of the relay. For remote communications more specialised equipment is required. See the section on Communications for further information.

7SG22 Iota

Input / Output Units

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Pre release

2010/02	Document reformat due to rebrand

Software Revision History

Contents

1. Commissioning

1.1 Required Test Equipment

1000V Insulation resistance test set.

A d.c. supply with nominal voltage within the working range of the relays d.c. auxiliary supply rating.

A d.c. supply with nominal voltage within the working range of the relays d.c. input rating.

Additional equipment for testing the communications channel:

Portable PC with fibre optic modem, or RS232 connections.

2. Inspection

Ensure that all connections are tight and in accordance with the relay wiring diagram and the scheme diagram. Check the relay is correctly programmed and fully inserted into the case. Ensure a working ReyLogiC scheme has been loaded and the description appears in the identifier screen.

3. Applying Settings

The relay settings for the particular application should be applied before any secondary testing occurs.
Ensure the version of logic scheme in the relay is the same as the schematic diagram. This can be viewed in the instrumentation menu.
Note the input and output relays must be programmed correctly before any scheme tests are carried out.

IOTA relays feature two alternative settings groups. In applications where more than one settings group is to be used then it may be necessary to test the relay in more than one configuration.

When using settings groups it is important to remember that the relay need not necessarily be operating according to the settings which are currently being displayed. There is an “active settings group” on which the relay operates and an “edit/view settings group” which is visible on the display and which can be altered. This allows the settings in one group to be altered while the protection continues to operate on a different unaffected group. This "active settings group” and the “edit settings group” are selected in the “System Configuration Menu”.

Elsewhere in the settings menu system, those settings which can be altered for different groups are indicated by the symbols G1, G2 etc in the top left of the display. Other settings are common to all groups.

4. Precautions

Ensure that the correct d.c. supply voltage and polarity is applied. See the relevant scheme diagrams for the relay connections.

5. Tests

5.1 Insulation

Connect together the terminals of the DC auxiliary supply circuit and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Connect together the terminals of the DC status input circuits and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Connect together the terminals of the output relay circuits and measure the insulation resistance between these terminals and all of the other relay terminals connected together and to earth.

Satisfactory values for the various readings depend upon the amount of wiring concerned. Where considerable multi-core wiring is involved a reading of 2.5 to 3.0 Megaohms can be considered satisfactory. For short lengths of wiring higher values can be expected. A value of 1.0 Megaohm or less should not be considered satisfactory and should be investigated.

Remove temporary connections.

5.2 Functional Testing

Configure the status input and output relays to the requirements of the schematic diagrams.

The IOTA range is equipped with comprehensive self testing routines which automatically check correct initialisation and processing operation. The “Protection Healthy” LED is under software control and if, after application of the correct DC supply, it gives a steady light this is an indication that the relay is functioning correctly. A flashing LED, or no LED light indicates faulty equipment or no dc supply present. As there are no user serviceable components in the withdrawable modules, faulty relays must be returned to the nearest Reyrolle Service Centre or area office.

Each status input should be energised in turn and checked for correct operation with the fascia.

Check the operation of each output relay by selecting it in the “Test Plant Control” setting.

The tests described above will prove the correct operation of the relay hardware and basic interface software. To prove the ReyLogiC scheme it will be necessary to perform a simulation test with auxiliary equipment to mimic the controlled plant.

6. Putting Into Service

Remove the external test connections and test plugs

Check that the d.c. supply fuses and links are inserted.

Check that all the relay settings are as recommended.

Test and reset the LED indication display

Replace the relay cover

Insert the trip links where fitted

7SG22 Iota

Programmable Logic Module

Document Release History

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Pre release

2010/02	Document reformat due to rebrand

Software Revision History

1 Maintenance Instructions

The Argus 7 is a maintenance free relay, with no user serviceable parts. During the life of the relay it should be checked for operation during the normal maintenance period for the site on which the product is installed. It is recommended the following tests are carried out :

1 Visual inspection of the metering display (every year)

2 Operation of output contacts (every 2 years)

3 Secondary injection of each element (every 5 years)

2 Defect Report Form

Form sheet for repairs and returned goods (fields marked with * are mandatory fields)

Sender:

*** Name, first name:**	Complete phone number (incl. country code):	Complete fax number (incl. country code):
Email address:	*** Org-ID and GBK reference:**	*** AWV:**

*** Order-/ reference-no (choosing at least 1 option):**

Order-no for repair:	order-/ delivery note-no for return of commission failure:	Beginning order-no for credit note demand:

Information concerning the product and its use:

*** Order Code (MLFB):**	Firmware version: V		*** Serial number:**
* Customer:	Product was in use approximately since:	Station/project:	Hotline Input no.:
Customer original purchase order number:	Delivery note number with position number:	Manufacturer:	

*** Type of order (choosing at least 1 option):**

☐ Repair	☐ Return of commission failure	☐ Credit Note
☐ Upgrade / Modification to ...	☐ Warranty repair	☐ Quotation (not repair V4 and current products! See prices in PMD)
	☐ For collection	

Type of failure:

☐ Device or module does not start up	☐ Mechanical problem	☐ Overload
☐ Sporadic failure	☐ Knock sensitive	☐ Transport damage
☐ Permanent failure	☐ Temperature caused failure	☐ Failure after ca ☐ hrs in use
☐ Repeated breakdown	☐ Failure after firmware update	

Error description:

☐ Display message:
(use separated sheet for more info)

☐ Active LED messages:

☐ Faulty Interface(s), which? ☐ Wrong measured value(s), which? ☐ Faulty input(s)/output(s), which?

***Detailed error description** (please refer to other error reports or documentation if possible):

*** Shall a firmware update be made during repair or mechanical upgrade of protective relays? (choosing at least 1 option)**

☐ Yes, to most recent version ☐ No ☐ Yes, actual parameters must be reusable

repair report:

☐ Yes, standard report (free of charge) ☐ Yes, detailed report (charge: 400EUR)

Shipping address of the repaired/upgraded product:

Company, department

Name, first name

Street, number

Postcode, city, country

Date, Signature

Please contact the Siemens representative office in your country to obtain return instructions.

E D EA MF TCC 6 release from 11/2009

7SG22 Iota

Input / Output Units

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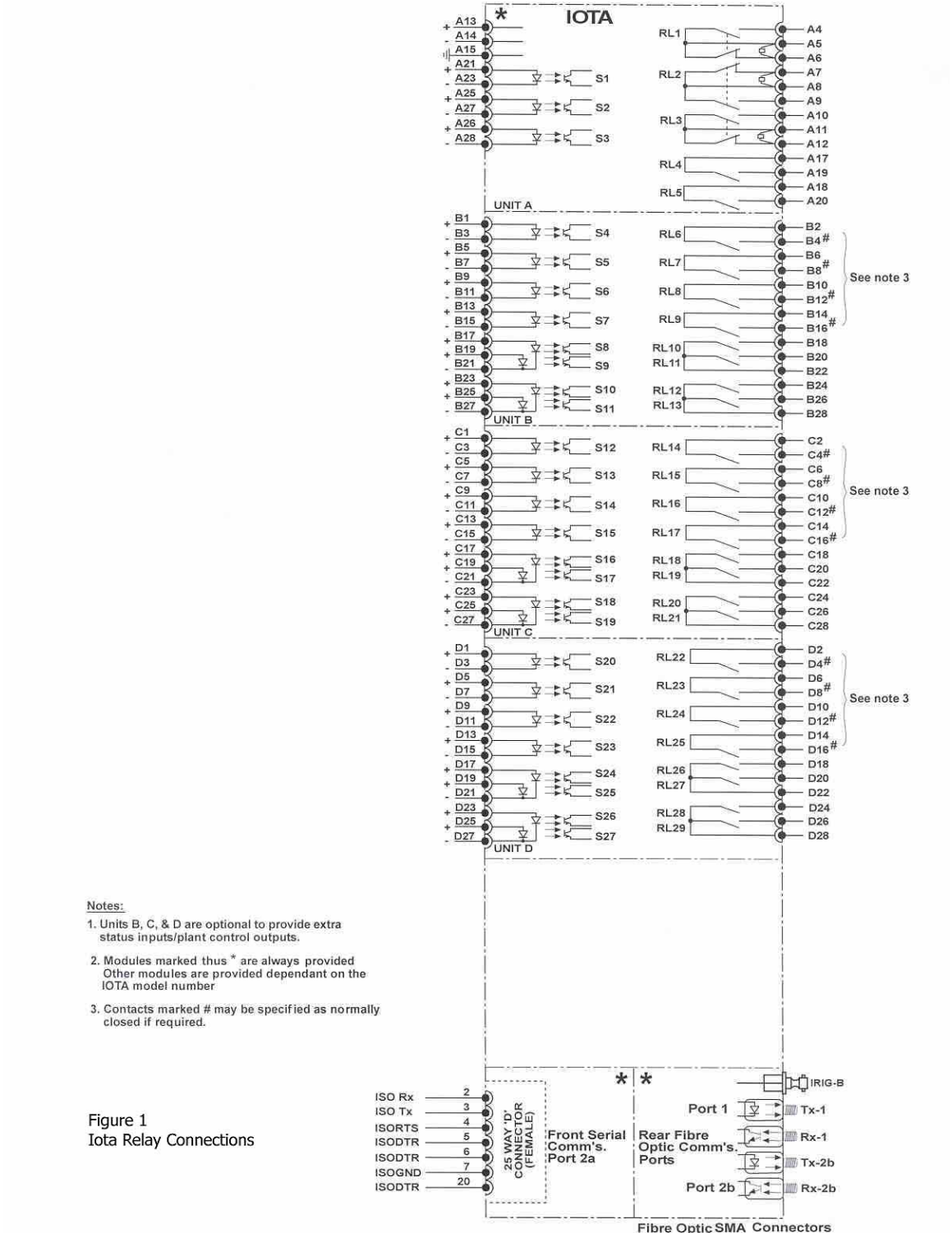
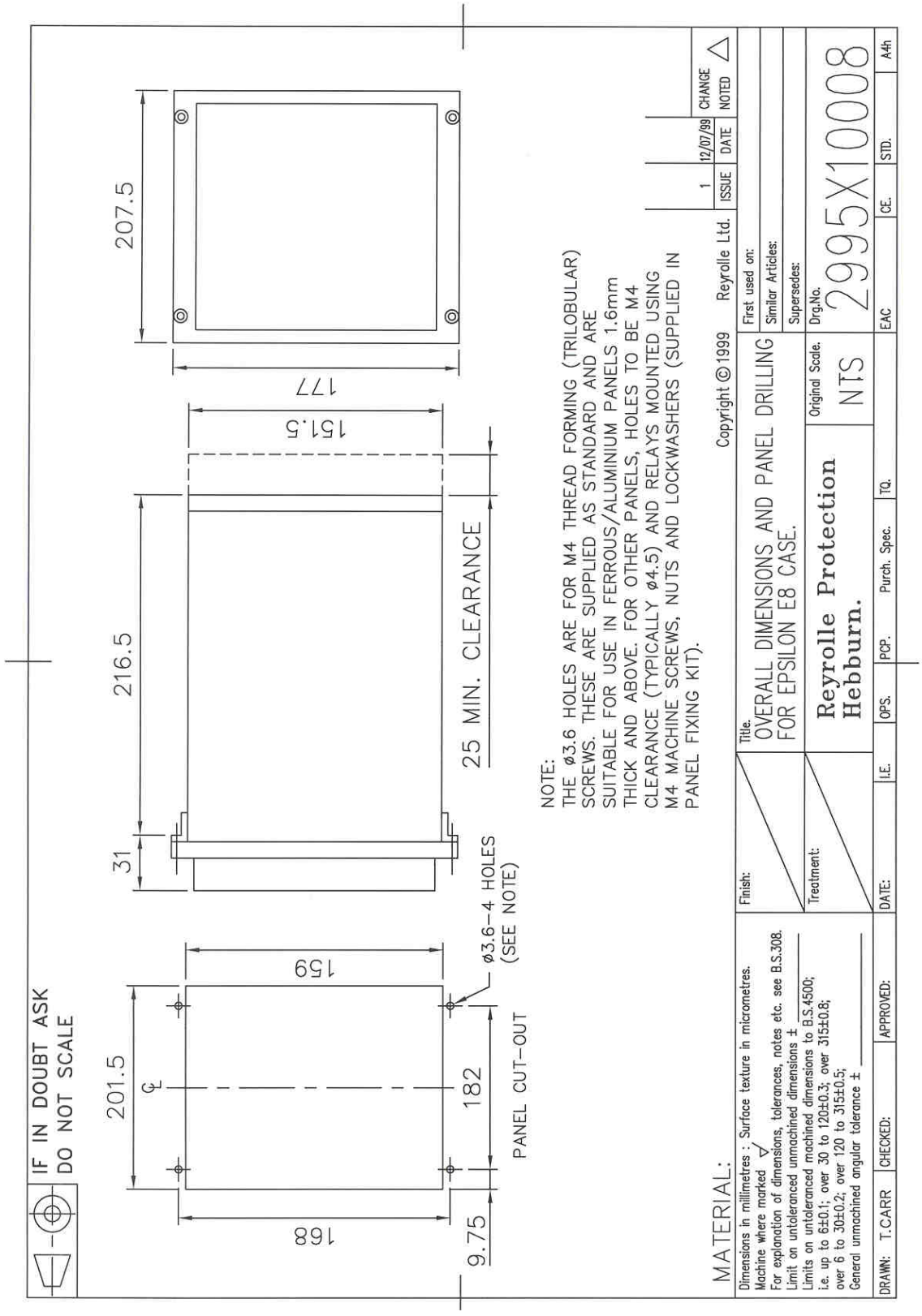
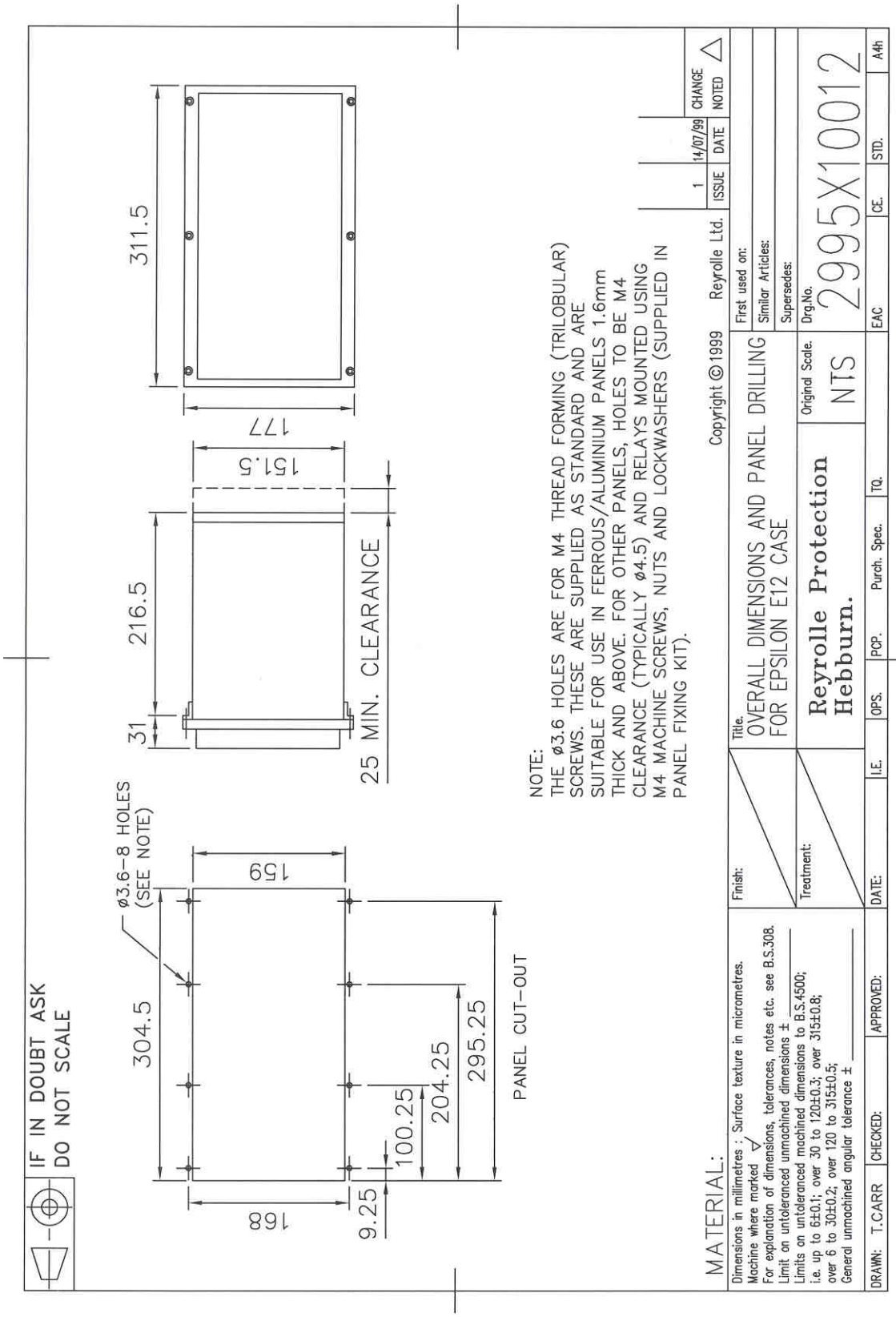


Notes:

1. Units B, C, & D are optional to provide extra status inputs/plant control outputs.
2. Modules marked thus * are always provided Other modules are provided dependant on the IOTA model number
3. Contacts marked # may be specified as normally closed if required.

Figure 1
Iota Relay Connections





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