7SG22 Iota

Input / Output Units

Document Release History

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

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Contents

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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.

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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.

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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.
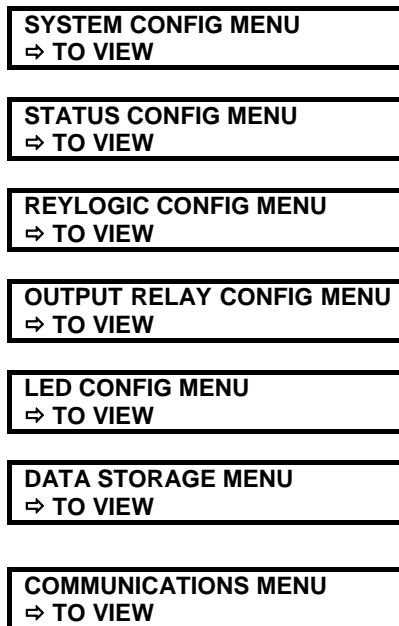
12. Settings and Displays

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.

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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.

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