7SG11 Argus 8

Voltage and Frequency Relays

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

2011/11	2422H80004R7	Fault trigger when the voltage blocking threshold is OFF. IEC 60870-5-103 fault numbering for fault and its measurands

Contents

Tables

1 Introduction

Before any commissioning work is carried out, the user should be familiar with the following sections :

- Section 1 - Description of Operation.
- Section 3 - Relay Settings.
- Section 6 - Installation. Particular attention should be paid to unpacking, storage and handling.

The Argus range of relays are fully numeric and incorporate many self-checking features which, if a fault occurs on the relay, will inhibit the protection functions of the relay and give an alarm output. This inherent self-checking gives high levels of confidence in the relays which means that commissioning tests do not have to be as comprehensive as with static or electromechanical type relays.

The recommended commissioning procedure for this type of numeric relay is to carry out the following tests :

1 Examine the relay for any damage.

2 Energise the relay and check that the hardware is working correctly.

3 Verify that the settings are as required for the application.

4 Verify that the external wiring is as required by the scheme diagram.

5 Perform secondary injection tests.

6 Perform on-load tests.

2 Required test equipment

The following equipment will be required to perform commissioning tests on Argus 8 relays.

- 500V Insulation resistance test set.
- A variable ac voltage source, ideally a portable relay test set e.g. Doble, Omicron etc.
- Electronic Timer. (Required only if portable relay test set is not available).
- Multimeter with ac and dc voltage ranges.
- A dc supply with nominal voltage within the working range of the relay's dc auxiliary supply rating.
- A dc supply with nominal voltage within the working range of the relay's dc status input rating.
- Continuity tester e.g. multimeter.
- Phase rotation meter.

Additional equipment for testing the communications channel :

- Portable PC with an electrical-to-optical RS232 converter and fibre optic connectors.
- A copy of Reydisp Evolution software installed on the PC to exercise the communications channel.
- Optional printer (for printing a hard copy of the settings file if required).

3 Commissioning tests

3.1 Inspection

Check that the relay has not been damaged in any way since being installed into the panel. Remove the relay from the case and check that the serial numbers of the relay, the case and the relay cover are all identical. Check also that the relay is the correct model and that the rating information is correct for the particular installation.

Ensure that all external connections are tight and that the relay case is solidly bonded to a local earth point by checking the earthing connection to the case. Replace the relay back into the case and check that it is fully inserted.

3.2 Insulation

When required, insulation tests to check the relay and associated wiring can be performed using a 500V electronic insulation resistance test set. The wiring may be tested between :-

1. All electrically isolated circuits.
2. All circuits to earth.

Accessible terminals of the same circuit should be connected together and deliberate circuit earthing links removed for the tests. Normal connections must be restored after testing. Satisfactory values for the various readings above depend upon the amount of wiring concerned. Where considerable multi-core wiring is involved a reading of 2.5 to 3.0 MΩ can be considered satisfactory. For short lengths of wiring higher values can be expected. A value of 1.0 MΩ or less should not be considered satisfactory and should be investigated.

We do not recommend a 2KV site pressure test on the secondary wiring with relays connected. If this has to be carried out then, as above, deliberate earth links must be removed. Note that both the positive and negative feeds to the relay's DC/DC converter are earthed via 5KV capacitors and the leakage current of these capacitors may trip the 2KV pressure test set. Also note that the capacitance effect of the secondary wiring may give rise to test set calibration errors that give impressed voltages higher than measured. To avoid this phenomenon, the pressure test set used should have the metering on the secondary (high voltage) side. Suitable test sets are manufactured by T&R Test Equipment (Type KV5 – 100).

While performing the tests, HV test voltages should be smoothly increased form zero and smoothly decreased to zero after the test to avoid arcing and trapped charge.

All Reyrolle relays are comprehensively pressure tested during manufacture.

3.3 Wiring Check

Check that the wiring to the back of the relay is as required by the external connection diagram or the relevant scheme diagram.

3.4 Auxiliary Supply Check

Before energising the relay check with a multimeter that the dc auxiliary supply voltage is within the operating range of the relay given in the table below :

	Rating (V)	Operating Range (V)
Vaux	24 / 30 / 48	18 – 60
Vaux	110 / 220	88 – 280

Note that the relay can withstand a superimposed ac ripple of upto 12% on the upper limit of the operative dc voltage range.

3.5 Energising the Relay

If the power supply is within the correct operating range then energise the relay. Indication of correct relay power up will be given by the green Protection Healthy LED being lit. This should be held

permanently on and should not flash. After the relay has completed its startup initialisation routines, the LCD backlight will be switched on the display will revert to whichever screen was last selected.

At this point a continuity tester can be used to check that the chosen watchdog relay contacts are in their correct position for a healthy energised relay.

3.6 Visual Inspection

If the relay is powered up and in a healthy state, remove the relay cover and perform the following checks :

1. Press **CANCEL** a number of times to so that the relay displays the identifier screen. Now press **TEST/RESET** so that an LED test is initiated. The yellow Starter and red Trip LED's should operate momentarily and the LCD will display 'LED Test' .
2. View the LCD from a point directly in front of the relay. If the LCD is too faint or too dark then adjust the contrast by inserting a small flat screwdriver into the hole on the fascia above the LCD. The potentiometer is a multi-turn type and may require a number of turns before any changes are seen. Turning clockwise will increase the contrast, anti-clockwise will reduce the contrast. Ensure that the contrast is not too dark otherwise scrolling alarm screens will not be displayed clearly.

3.7 Precautions

Before testing commences the relay should be isolated from the voltage transformers in line with the local site procedures. The closing and alarm circuits should also be isolated where practical. Ensure that the correct dc auxiliary voltage is applied to the circuit. See the relevant scheme diagrams for the relay connections.

3.8 Status Input Tests

This test checks that the status input circuits are functioning correctly. The status input circuits should be energised in turn and observed to be operating using the instruments mode 'Status Inputs' display. A '1' indicates that the status circuit is energised, a '_' indicates that it is not.

Note : if the Status Invert feature is used, then when an input is externally energised, the instrument display will show a '_'. When the input is de-energised it will display a '1'.

Connect the correct dc voltage to the following terminals to energise the status inputs :

For E4 case size relays :

Status Input	+ DC Volts	- DC Volts
Status 1	5	6
Status 2	27	28
Status 3	26	28
Status 4	25	28

For E6 case size relays :

Status Input	+ DC Volts	- DC Volts
Status 1	3	4
Status 2	35	36
Status 3	33	34
Status 4	31	32
Status 5	29	30
Status 6	43	44
Status 7	41	42
Status 8	39	40
Status 9	37	38

Record the operation of the Status Inputs in Table 1.

3.9 Output Relay Tests

This test checks that the output relays are functioning correctly. The output relays should be energised in turn and the contacts should be checked for correct operation using a continuity tester. The output relays can be energised in a number of ways. The following is the recommended method :

Assign each output relay in turn to 'Protection Healthy' in the output relay menu. On pressing the **ENTER** key the output relay selected will be energised. Check with a continuity tester that the actual contacts have operated. De-select the output relay and check that the contact returns.

(Assigning the output relays to 'Protection Healthy' ensures that they stay energised until they are de-selected. Otherwise, if they were assigned to a protection element, they may only be energised for the minimum output contact time, which is 100ms. This might not be long enough time for a continuity tester to register.)

Connect the continuity tester between the following terminals to test the output relays :

For E4 case size relays :

Output Relay	Type	Terminal No.
Relay 1	N/C	7 – 8
Relay 2	N/O	9 – 10
Relay 3	C/O	17 (COM) 18 (N/C) 16 (N/O)
Relay 4	N/O	11 – 12
Relay 5	N/O	19 – 20
Relay 6	N/O	21 – 22
Relay 7	N/O	23 – 24

For E6 case size relays :

Output Relay	Type	Terminal No.
Relay 1	C/O	6 (COM) 5 (N/C) 7 (N/O)
Relay 2	C/O	9 (COM) 10 (N/C) 8 (N/O)
Relay 3	C/O	17 (COM) 18 (N/C) 16 (N/O)
Relay 4	N/O	11 – 12
Relay 5	N/O	19 – 20
Relay 6	N/O	21 – 22
Relay 7	N/O	23 – 24
Relay 8	N/O	37 – 38
Relay 9	N/O	39 – 40
Relay 10	N/O	41 – 42
Relay 11	N/O	43 – 44

Note : when finished testing the output relays make sure that the 'Protection healthy' is re-assigned to the correct output relay given in the settings file and that all other relays have been de-selected from this option.

Record the operation of the Output Relays in Table 2.

3.10 Voltage Input Tests

This test checks that the voltage measurements are within acceptable tolerances.

Apply rated ac volts to each of the voltage input circuits of the relay, in turn, using the ac variable voltage source or the portable relay test set. Using a multimeter check the voltage at the relay terminals. This should equal the voltage displayed on the relay's secondary voltage displays, although there is a tolerance of ± 2% on the measurement display meters. If a phase VT ratio has been set, then the primary instrument displays can be viewed. These will be scaled by the 'Ph VT Ratio' setting.

Relay Case Size	Voltage Input Type	Apply Voltage Between Terminals
E4	Va (Vab)	1 – 2
E4	Vo (Vbc)	3 – 4
E6	Va (Vab)	55 – 56
E6	Vb (Vbc)	53 – 54
E6	Vc (Vca)	51 – 52

Record the measured and displayed voltages in Table 3.

3.11 Applying Settings

Wherever possible, the relay should be commissioned with the actual settings calculated for the particular scheme. If this is not practical, however, one of the unused settings groups could be used as a commissioning test group. For information on selecting 'Active Settings Groups', see Section 1 of this manual. Note that Alarm and Tripping contacts must be programmed correctly before any scheme tests are carried out.

Settings can be entered into the relay using the keypad on the front of the relay or they can be sent to the relay, from a file, using a portable PC and the Reydisp Evolution software package. Entering the settings by hand can be a slow process and therefore using a previously prepared settings file is the recommended method. Using Reydisp Evolution also allows a hardcopy of the settings file to be easily acquired and saved.

Once the settings have been entered they will have to be verified. This is not essential, however, if the settings have been uploaded using Reydisp Evolution. If they have been entered by hand then the user should step through the relay settings list and compare them with the required setting record. (Note : see the Appendix section of this manual for Setting Configuration Sheets).

3.12 Optional Test

It is not necessary to perform tests on all internal elements of the relay. If the settings have been verified, the external wiring checked, the status inputs and output relays verified and the relay measures satisfactorily then the relay can be considered to be working to its design requirements. It will operate correctly, to the performance claims, and its operation under all service conditions is guaranteed. For this reason it is not essential to test the operation of any of the internal relay elements. However, if added confidence is required, then an element can be checked. Ideally an element employed in the scheme would be the best candidate to be tested. The following example shows the basic testing of a Voltage Element.

3.12.1 Under/Over Voltage Element

Using either the scheme settings or convenient settings, which are suitable for the limitations of the available test equipment, energise a Voltage Element and record its pick-up and drop-off values in Table 3. The pick-up and drop-off will be indicated by the yellow starter LED coming on, though more detailed information is given at the starter screens in the instruments display mode of the menu system e.g. the following display :

V Starters **VE1**

Set the Delay Time to 0.00 sec so that the instantaneous operate time of the chosen voltage element can be determined. Curves showing the instantaneous operate time for voltage elements are given in Section 2 of this manual. Take 3 timings and average them to get the instantaneous operate time. (Note that the instantaneous operate time is dependant upon the level of undervoltage applied).

Apply a Delay Time, ideally the time required for the scheme. Take 3 timings and average the values. The overall delay time should be the sum of the instantaneous operate time and the DTL time. Record the times in Table 4.

Performing this test is all that is essentially required to prove that the relay is functioning correctly. This is because the timing test also proves that the crystal oscillator, which clocks the microprocessor, is running at the correct frequency.

4 Putting into service

After all of the tests have been performed satisfactorily the relay should be put into service as follows :

- Remove all test connections and replace any external wiring, which may have been removed to allow testing.
- Replace all fuses and links.
- It is important to check that the correct settings group is active, if more than one group has been programmed.

4.1 On-load Testing

This test should only be performed if there are no restrictions on energising the system which is being commissioned.

Energise the system and measure the secondary voltages. Compare these with the relay's measured values which are displayed in the instruments display mode. The values should compare and be within ± 2%.

Look at the relay's primary voltage displays. These will be indicating the primary voltages which have been scaled to the correct ratio of the line voltage transformers.

If the relay is a 2 pole version and has been configured as 2Ph-Ph connection, or a 3 pole version, configured as 3Ph-Ph or 3Ph-N+NVD, then look at the V1 and V2 instruments displays. These will prove that the system phasing is correct. For correct phasing and rated system volts the V1 instrument should read full rated volts and the V2 instrument should read 0V.

If the relay versions are not configured as mentioned above, then test that the system volts are phased correctly using a phase rotation meter.

4.2 Final Checks

- Remove any test leads and links which have been used during the on-load testing phase.
- In the CB Maintenance menu reset the Trip Counter if any trips have been registered.
- Reset any alarms and LED's.
- Replace the relay cover and secure.

If a password has been entered the relay will automatically log the user out after a time of 1 hour has elapsed.

5 Trouble shooting

OBSERVATION	ACTION
Relay does not power up.	Check that the correct auxiliary DC voltage is applied and that the polarity is correct.
Relay won't accept the password.	The Password being entered is wrong. Enter correct password. If correct password has been forgotten, note down the Numeric Code which is displayed at the Change Password screen e.g. Change Password Code= 123456789 To retrieve the password communicate this code to the nearest Reyrolle representative.
Protection Healthy LED flashes	General failure. Contact Reyrolle.
LCD screen flashes continuously.	The LCD has many possible error messages which when displayed will flash continuously. These indicate various processor card faults. General failure. Contact Reyrolle.
Backlight is on but no text can be seen.	Adjust the contrast.
Scrolling text messages are unreadable.	Adjust the contrast.
Relay displays one instrument after another with no user intervention.	Default instruments are enabled. Remove all instruments from the default list and only add those which are required. Frequency 50.003Hz D The 'D' indicates that the instrument is a default instrument. Press **ENTER** to deselect it. (See Description of Operation – subsection 4.5 of this manual).
The LCD is stuck at the 'General Alarms' screen and is displaying 'Trip Circuit Failure Sx'. (x = 1..5)	The trip circuit failure feature is enabled and is expecting a healthy status input signal. Energise the correct Status Input, or disable the trip circuit feature if it is not required.
Cannot communicate with the relay.	• Check that all of the communications settings match those used by Reydisp Evolution. • Check that the Tx and Rx fibre-optic cables are connected correctly. (Tx –> Rx and Rx –> Tx). • Check that all cables, modems and fibre-optic cables work correctly. • Set the line idle setting to Light On. Examine the Tx port on the back of the relay, with the fibre removed, and check that it is glowing red. If it is not then the communications board on the case may not be aligned correctly with the processor card socket. Contact Reyrolle. (WARNING : DO NOT LOOK AT THE FIBRE-OPTIC TRANSMITTER FOR A PROLONGED TIME). (See Communications Interface section of this manual).
Relays will not communicate in a ring network.	• Check that the Data Echo setting on all relays is set to ON. • Check that all relays are powered up. • Check that all relays have unique addresses.

Status inputs do not work.	• Check that the correct DC voltage is applied and that the polarity is correct. • Check that the status input settings such as the Pick-up and Drop-off timers and the status inversion function are correctly set.
Relay instrument displays show small voltages even though the system is dead.	• This is normal. The relay is displaying calculation noise. This will not affect any accuracy claims for the relay.

If the above checklist does not help in correcting the problem please contact your nearest Reyrolle representative.

Appendix 1 : COMMISSIONING TEST RESULTS

Date :	
Station :	
Circuit :	

RELAY INFORMATION

Relay Type	
Article Number	
Serial Number	
Auxiliary Voltage (Vx)	V dc
Rated Frequency (Fn)	Hz
Status Input Voltage	V dc

STATUS INPUT TESTS

Status Input	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**
Working ? (Yes / No / N/A)									

Table 1 - Status Input Tests

OUTPUT RELAY TESTS

Output Relay	**RL1**	**RL2**	**RL3**	**RL4**	**RL5**	**RL6**	**RL7**	**RL8**	**RL9**	**RL10**	**RL11**
Working ? (Yes / No / N/A)											

Table 2 - Output Relay Tests

Input Pole	Voltage @ Relay Terminals (V)	Relay Secondary Displays (V)	VT Ratio	Relay Primary Displays (V)	PASS / FAIL
Va (Vab)					
Vb (Vbc)					
Vc (Vca)					
Vo					

Table 3 - Measured Voltages

V Element Number	Operation Mode	O/P Phases	Output Relay(s)				
Setting (V)	Hysteresis (%)	PU Level (V)	DO Level (V)	PU Error (%)	DO Error (%)	Ratio (%)	PASS / FAIL
Delay Time (sec)	Operate Time 1 (sec)	Operate Time 2 (sec)	Operate Time 3 (sec)	Average Time (sec)			PASS / FAIL

Table 4 - Under/Over Voltage Element Tests