

7SG14 Duobias-M

Transformer Protection

Document Release History

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

Revision	Date	Description
	2010/02	Document reformat due to rebrand
R9	21/09/2006	Reformatted to match other manual sections
R8	13/09/2005	Corrected TCS setting names
R7	11/08/2005	Differential elements now appear in groups and settings texts altered to fit LCD. 87 element renamed to be 87BD to help differentiate from 87HS and 87REF elements
R6	01/07/2005	Dual Stack IEC 60870-5-103 and/or Modbus-RTU communications added. IEC 60870-5-103 Measurands added IEC 60870-5-103 Output Relay controls added. Reylogic Control Menu removed. Settings order in I/O menu has changed Phase N Outputs added
R5	03/03/2004	Correct E8 label (74TC)
R4	09/12/2003	Added new inrush bias settings
R3	03-12-2003	Brought up to date with Revision 11 firmware, now includes Data Storage menu options for triggering waveforms, resetting of waveforms, events and faults.
R2	02-06-2003	Brought up to date with Revision 9 firmware.
R1	03-05-2002	First Version.

Software Revision History

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1 Introduction

This relay settings section covers the following Duobias-M models:-

Model No	Cat No	Configuration No
Duobias-M-201-2W-E8-50Hz	DU3-203-*A-50	2661H80033R15
Duobias-M-201-2W-50Hz	DU3-203-**-50	2661H80032R15
Duobias-M-201-2W-60Hz	DU3-203-**-60	2661H80031R15
Duobias-M-201-3W-50Hz	DU3-303-**-50	2661H80047R15
Duobias-M-201-3W-60Hz	DU3-303-**-60	2661H80046R15

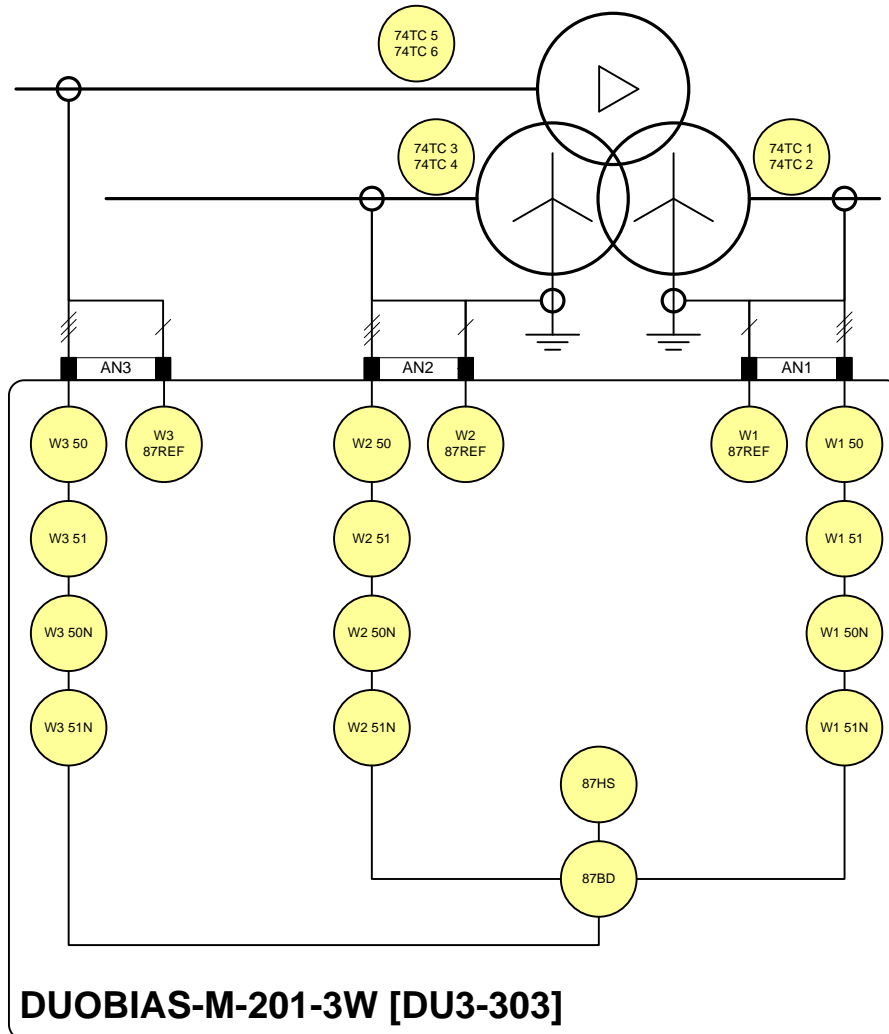


Figure 1 - Duobias-M-201-3W [DU3-303]

2 DUOBIAS-M-201-2W/3W Relay Setting List

2.1 System Config Menu

Description	Range	Default	Setting
Active Group <i>Selects which settings group is currently activated</i>	1,2...8	1	
View/Edit Group <i>Selects which settings group is currently being displayed</i>	1,2...8	1	
Default Screens Timer <i>Selects the time delay after which, if no key presses have been detected, the relay will begin to poll through any screens which have been selected as default instruments screens</i>	OFF, 1,2,5,10,15,30,60 min	60 min	
Backlight timer <i>Controls when the LCD backlight turns off</i>	OFF, 1,2,5,10,15,30,60 min	5 Min	
Date	Date	1/1/1980	
Time	Time	00:00:00	
Clock Sync. From Status <i>Real time clock may be synchronised using a status input (See Clock Sync. in Status Input Menu)</i>	Disabled, Seconds, Minutes	Minutes	
Operating Mode <i>To allow access to change configuration files using Reylogic Toolbox the relay must be placed Out Of Service.</i>	Local, Remote, Local Or Remote, Out Of Service	Local Or Remote	
Change Password <i>Allows a 4 character alphanumeric code to be entered as the password. Note that the display shows a password dependant encrypted code on the second line of the display</i>	AAAA...ZZZZ	"NONE" displayed as "NOT ACTIVE"	
Relay Identifier <i>An alphanumeric string shown on the LCD normally used to identifier the circuit the relay is attached to or the relays purpose</i>	Up to 16 characters	DUOBIAS-M-201-2W/3W	

2.2 CT/VT Config Menu

Description	Range	Default	Setting
W1 Input <i>Selects whether 1 or 5 Amp terminals are being used for winding 1</i>	1,5 A	1 A	
W1 CT Ratio <i>Winding 1 CT ratio to scale primary current instruments</i>	5:0.2...5000:7	2000:1	
W1 REF Input <i>Selects whether 1 or 5 Amp terminals are being used for winding 1REF</i>	1,5 A	1 A	
W1 REF CT Ratio <i>Winding 1 REF CT ratio to scale primary current instruments</i>	5:0.2...5000:7	2000:1	
W2 Input <i>Selects whether 1 or 5 Amp terminals are being used for winding 2</i>	1,5 A	1 A	
W2 CT Ratio <i>Winding 2 CT ratio to scale primary current instruments</i>	5:0.2...5000:7	2000:1	
W2 REF Input	1,5 A	1 A	

Description	Range	Default	Setting
Selects whether 1 or 5 Amp terminals are being used for winding 2 REF			
W2 REF CT Ratio Winding 2 REF CT ratio to scale primary current instruments	5:0.2...5000:7	2000:1	
W3 Input ¹ Selects whether 1 or 5 Amp terminals are being used for winding 3	1,5 A	1 A	
W3 CT Ratio ¹ Winding 3 CT ratio to scale primary current instruments	5:0.2...5000:7	2000:1	
W3 REF Input ¹ Selects whether 1 or 5 Amp terminals are being used for winding 3 REF	1,5 A	1 A	
W3 REF CT Ratio ¹ Winding 1 REF CT ratio to scale primary current instruments	5:0.2...5000:7	2000:1	

1) 3W Only

2.3 Biased Differential Menu

Description	Range	Default	Setting
W1 Interposing CT Multiplier Winding 1 scaling factor	0.25,0.26...3.00 x	1.00 x	
W1 Interposing CT Connection Winding 1 transformer vector group compensation and/or zero sequence filtering	Yy0, Yd1, Yy2, Yd3, Yy4, Yd5, Yy6, Yd7, Yy8, Yd9, Yy10, Yd11, Ydy0	Yy0, 0°	
W2 Interposing CT Multiplier Winding 2 scaling factor	0.25,0.26...3.00 x	1.00 x	
W2 Interposing CT Connection Winding 2 transformer vector group compensation and/or zero sequence filtering	Yy0, Yd1, Yy2, Yd3, Yy4, Yd5, Yy6, Yd7, Yy8, Yd9, Yy10, Yd11, Ydy0	Yy0, 0°	
W3 Interposing CT Multiplier ¹ Winding 3 scaling factor	0.25,0.26...3.00 x	1.00 x	
W3 Interposing CT Connection ¹ Winding 3 transformer vector group compensation and/or zero sequence filtering	Yy0, Yd1, Yy2, Yd3, Yy4, Yd5, Yy6, Yd7, Yy8, Yd9, Yy10, Yd11, Ydy0	Yy0, 0°	
87 Inrush Element Selects whether the biased differential characteristic is inhibited from operating when magnetising inrush is detected	Disabled, Enabled	Enabled	
87 Inrush Bias Selects the bias method used for magnetising inrush Phase – Segregated, each phase blocks itself. Cross – Blocked, each phase can block the operation of other phases (Modular 1 method). Sum - Of Squares, each phase blocks itself using the square root of the sum of squares of the even harmonics. (Improves SOTF performance when REF not applied).	Phase, Cross, Sum	Cross	
87 Inrush Setting The magnetising inrush detector operates when the even harmonics in the differential operate current exceed a set percentage of the differential operate current	0.1,0.11...0.50 xld	0.20 xld	
87BD Element Selects whether the transformer	Disabled, Enabled	Disabled	

Description	Range	Default	Setting
<i>differential protection element is enabled</i>			
87BD Initial Setting <i>The initial unbiased pickup level</i>	0.1,0.15...2.00 xIn	0.20 xIn	
87BD Bias Slope <i>The bias slope varies the pickup level to compensates for CT measuring errors and tap changer not mid tap errors as the through current (bias) increases</i>	0,0.05...0.7 x	0.20 x	
87BD Bias Slope Limit <i>At this point in the characteristics the bias slope increases tot provide increased security when additional measuring errors are introduced due to CT saturation effects.</i>	1,2...20 xIn	4 xIn	
87BD Delay <i>The operation of the differential may be delayed to cater for special system conditions e.g. for use on cable circuits a delay of 5ms is recommended</i>	0.005,0.010...1 s	0.005 s	
87HS Element <i>Selects whether the differential Highset element is enabled. Note this element is never blocked by magnetising inrush</i>	Disabled, Enabled	Disabled	
87HS Setting <i>the differential setting pickup setting</i>	1,2...30 xIn	4 xIn	
87HS Delay <i>the operation of the differential may be delayed to cater for special system conditions e.g. for use on cable circuits a delay of 5ms is recommended</i>	0.005,0.010...1 s	0.005 s	

1) 3W Only

2.4 Winding 1 Menu

Description	Range	Default	Setting
Gn W1 51 Element <i>Selects whether the winding 1 IDMTL Overcurrent element is enabled</i>	Disabled, Enabled	Disabled	
Gn W1 51 Setting <i>Pickup level</i>	0.05,0.10...2.5 xIn	1.5 xIn	
Gn W1 51 Char <i>Selects characteristic curve or DTL operation</i>	IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI, DTL	IEC-NI	
Gn W1 51 Time Mult (IEC/ANSI) <i>Time multiplier (applicable to IEC and ANSI curves but not DTL selection)</i>	0.025, 0.050...1.600	1.000	
Gn W1 51 Delay (DTL) <i>Delay (applicable only when DTL is selected for characteristic)</i>	0, 0.01...20 s	5 s	
Gn W1 51 Reset <i>Selects between an ANSI decaying reset characteristic or a definite time reset</i>	(ANSI) Decaying, INST, 1,2,...60 s	INST	
Gn W1 50 Element <i>Selects whether the winding 1 DTL Overcurrent element is enabled</i>	Disabled, Enabled	Disabled	
Gn W1 50 Setting <i>Pickup level</i>	0.05, 0.10...25 xIn	20 xIn	
Gn W1 50 Delay <i>Pickup delay</i>	0,0.01...864000 s	0.01	
Gn W1 51N Element <i>Selects whether the winding 1 IDMTL derived Earth Fault element is enabled</i>	Disabled, Enabled	Disabled	
Gn W1 51N Setting <i>Pickup level</i>	0.10,0.15...2.5 xIn	1.0 xIn	
Gn W1 51N Char	IEC-NI, IEC-VI, IEC-EI, IEC-	IEC-NI	

Description	Range	Default	Setting
Selects characteristic curve or DTL operation	LTI, ANSI-MI, ANSI-VI, ANSI-EI, DTL		
Gn W1 51N Time Mult (IEC/ANSI) Time multiplier (applicable to IEC and ANSI curves but not DTL selection)	0.025, 0.050...1.600	1.000	
Gn W1 51N Delay (DTL) Delay (applicable only when DTL is selected for characteristic)	0, 0.01...20 s	5 s	
Gn W1 51N Reset Selects between an ANSI decaying reset characteristic or a definite time reset	(ANSI) Decaying, INST, 1,2...60 s	INST	
Gn W1 50N Element Selects whether the winding 1 DTL derived Earth fault element is enabled	Disabled, Enabled	Disabled	
Gn W1 50N Setting Pickup level	0.10, 0.15...25 xIn	0.5 xIn	
Gn W1 50N Delay Pickup delay	0,0.01...864000 s	0.02	
Gn W1 87REF High impedance restricted earth fault current element	Disabled, Enabled	Disabled	
Gn W1 87REF Setting Pickup level	0.020,0.025...0.960 xIn	0.200 xIn	
Gn W1 87REF Delay Pickup delay	0,0.0025...864000 s	0.0000	

2.5 Winding 2 Menu

Description	Range	Default	Setting
Gn W2 51 Element Selects whether the winding 2 IDMTL Overcurrent element is enabled	Disabled, Enabled	Disabled	
Gn W2 51 Setting Pickup level	0.05,0.10...2.5 xIn	1.5 xIn	
Gn W2 51 Char Selects characteristic curve or DTL operation	IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI, DTL	IEC-NI	
Gn W2 51 Time Mult (IEC/ANSI) Time multiplier (applicable to IEC and ANSI curves but not DTL selection)	0.025, 0.050...1.600	1.000	
Gn W2 51 Delay (DTL) Delay (applicable only when DTL is selected for characteristic)	0, 0.01...20 s	5 s	
Gn W2 51 Reset Selects between an ANSI decaying reset characteristic or a definite time reset	(ANSI) Decaying, INST, 1,2...60 s	INST	
Gn W2 50 Element Selects whether the winding 2 DTL Overcurrent element is enabled	Disabled, Enabled	Disabled	
Gn W2 50 Setting Pickup level	0.01, 0.02...25 xIn	20 xIn	
Gn W2 50 Delay Pickup delay	0,0.01...864000 s	0.01	
Gn W2 51N Element Selects whether the winding 2 IDMTL derived Earth Fault element is enabled	Disabled, Enabled	Disabled	
Gn W2 51N Setting Pickup level	0.10,0.15...2.5 xIn	1.0 xIn	
Gn W2 51N Char Selects characteristic curve or DTL operation	IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI, DTL	IEC-NI	
Gn W2 51N Time Mult (IEC/ANSI) Time multiplier (applicable to IEC and ANSI curves but not DTL selection)	0.025, 0.050...1.600	1.000	
Gn W2 51N Delay (DTL)	0, 0.01...20 s	5 s	

Description	Range	Default	Setting
<i>Delay (applicable only when DTL is selected for characteristic)</i>			
Gn W2 51N Reset <i>Selects between an ANSI decaying reset characteristic or a definite time reset</i>	(ANSI) Decaying, INST, 1,2...60 s	INST	
Gn W2 50N Element <i>Selects whether the winding 2 DTL derived Earth fault element is enabled</i>	Disabled, Enabled	Disabled	
Gn W2 50N Setting <i>Pickup level</i>	0.10, 0.15...25 xIn	0.5 xIn	
Gn W2 50N Delay <i>Pickup delay</i>	0,0.01...864000 s	0.02	
Gn W2 87REF <i>High impedance restricted earth fault current element</i>	Disabled, Enabled	Disabled	
Gn W2 87REF Setting <i>Pickup level</i>	0.020,0.025...0.960 xIn	0.200 xIn	
Gn W2 87REF Delay <i>Pickup delay</i>	0,0.0025...864000 s	0.0000	

2.6 Winding 3 Menu¹

Description	Range	Default	Setting
Gn W3 51 Element <i>Selects whether the winding 3 IDMTL Overcurrent element is enabled</i>	Disabled, Enabled	Disabled	
Gn W3 51 Setting <i>Pickup level</i>	0.05,0.10...2.5 xIn	1.5 xIn	
Gn W3 51 Char <i>Selects characteristic curve or DTL operation</i>	IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI, DTL	IEC-NI	
Gn W3 51 Time Mult (IEC/ANSI) <i>Time multiplier (applicable to IEC and ANSI curves but not DTL selection)</i>	0.025, 0.050...1.600	1.000	
Gn W3 51 Delay (DTL) <i>Delay (applicable only when DTL is selected for characteristic)</i>	0, 0.01...20 s	5 s	
Gn W3 51 Reset <i>Selects between an ANSI decaying reset characteristic or a definite time reset</i>	(ANSI) Decaying, INST, 1,2...60 s	INST	
Gn W3 50 Element <i>Selects whether the winding 2 DTL Overcurrent element is enabled</i>	Disabled, Enabled	Disabled	
Gn W3 50 Setting <i>Pickup level</i>	0.01, 0.02...25 xIn	20 xIn	
Gn W3 50 Delay <i>Pickup delay</i>	0,0.01...864000 s	0.01	
Gn W3 51N Element <i>Selects whether the winding 3 IDMTL derived Earth Fault element is enabled</i>	Disabled, Enabled	Disabled	
Gn W3 51N Setting <i>Pickup level</i>	0.10,0.15...2.5 xIn	1.0 xIn	
Gn W3 51N Char <i>Selects characteristic curve or DTL operation</i>	IEC-NI, IEC-VI, IEC-EI, IEC-LTI, ANSI-MI, ANSI-VI, ANSI-EI, DTL	IEC-NI	
Gn W3 51N Time Mult (IEC/ANSI) <i>Time multiplier (applicable to IEC and ANSI curves but not DTL selection)</i>	0.025, 0.050...1.600	1.000	
Gn W3 51N Delay (DTL) <i>Delay (applicable only when DTL is selected for characteristic)</i>	0, 0.01...20 s	5 s	
Gn W3 51N Reset <i>Selects between an ANSI decaying reset characteristic or a definite time reset</i>	(ANSI) Decaying, INST, 1,2...60 s	INST	
Gn W3 50N Element	Disabled, Enabled	Disabled	

Description	Range	Default	Setting
Selects whether the winding 3 DTL derived Earth fault element is enabled			
Gn W3 50N Setting Pickup level	0.10, 0.15...25 xIn	0.5 xIn	
Gn W3 50N Delay Pickup delay	0,0.01...864000 s	0.02	
Gn W3 87REF High impedance restricted earth fault current element	Disabled, Enabled	Disabled	
Gn W3 87REF Setting Pickup level	0.020,0.025...0.960 xIn	0.200 xIn	
Gn W3 87REF Delay Pickup delay	0,0.0025...864000 s	0.0000	

1) 3W Only

2.7 Trip Circuit Supervision Menu

Description	Range	Default	Setting
Trip Cct Fail 1 Selects if this trip circuit logic is enabled or disabled.	Disabled, Enabled	Disabled	
Trip Cct Fail 1 Pickup Delay Delay before trip circuit failure picks up. Use in conjunction with STATUS INPUT MENU/Trip Cct Fail 1 setting to configure which status inputs prevent this timer from operating.	0,1...60000 ms	400 ms	
Trip Cct Fail 2	Disabled, Enabled	Disabled	
Trip Cct Fail 2 Pickup Delay	0,1...60000 ms	400 ms	
Trip Cct Fail 3	Disabled, Enabled	Disabled	
Trip Cct Fail 3 Pickup Delay	0,1...60000 ms	400 ms	
Trip Cct Fail 4	Disabled, Enabled	Disabled	
Trip Cct Fail 4 Pickup Delay	0,1...60000 ms	400 ms	
Trip Cct Fail 5 ¹	Disabled, Enabled	Disabled	
Trip Cct Fail 5 Pickup Delay ¹	0,1...60000 ms	400 ms	
Trip Cct Fail 6 ¹	Disabled, Enabled	Disabled	
Trip Cct Fail 6 Pickup Delay ¹	0,1...60000 ms	400 ms	

1) 3W Only

2.8 Status Input Menu

Description	Range	Default	Setting
Inhibit W1 51 Selects which inputs inhibit the W1 51 element	NONE, 1...27 ²	NONE	
Inhibit W1 50 Selects which inputs inhibit the W1 50 element	NONE, 1...27 ²	NONE	
Inhibit W1 51N Selects which inputs inhibit the W1 51N element	NONE, 1...27 ²	NONE	
Inhibit W1 50N Selects which inputs inhibit the W1 50N element	NONE, 1...27 ²	NONE	
Inhibit W1 87REF Selects which inputs inhibit the W1 87REF element	NONE, 1...27 ²	NONE	
Inhibit W2 51 Selects which inputs inhibit the W2 51 element	NONE, 1...27 ²	NONE	
Inhibit W2 50 Selects which inputs inhibit the W2 50 element	NONE, 1...27 ²	NONE	

Description	Range	Default	Setting
Inhibit W2 51N <i>Selects which inputs inhibit the W2 51N element</i>	NONE, 1...27 ²	NONE	
Inhibit W2 50N <i>Selects which inputs inhibit the W2 50N element</i>	NONE, 1...27 ²	NONE	
Inhibit W2 87REF <i>Selects which inputs inhibit the W2 87REF element</i>	NONE, 1...27 ²	NONE	
Inhibit W3 51 ¹ <i>Selects which inputs inhibit the W3 51 element</i>	NONE, 1...27 ²	NONE	
Inhibit W3 50 ¹ <i>Selects which inputs inhibit the W3 50 element</i>	NONE, 1...27 ²	NONE	
Inhibit W3 51N ¹ <i>Selects which inputs inhibit the W3 51N element</i>	NONE, 1...27 ²	NONE	
Inhibit W3 50N ¹ <i>Selects which inputs inhibit the W3 50N element</i>	NONE, 1...27 ²	NONE	
Inhibit W3 87REF ¹ <i>Selects which inputs inhibit the W3 87REF element</i>	NONE, 1...27 ²	NONE	
Inhibit 87BD <i>Selects which inputs inhibit the 87BD element</i>	NONE, 1...27 ²	NONE	
Inhibit 87HS <i>Selects which inputs inhibit the 87HS element</i>	NONE, 1...27 ²	NONE	
Trip Cct Fail 1 <i>Select which inputs block Trip Cct Fail 1 timer. If any of the selected inputs is energised then the trip circuit timer 1 is blocked.</i>	NONE, 1...27 ²	NONE	
Trip Cct Fail 2 <i>Select which inputs block Trip Cct Fail 2 timer.</i>	NONE, 1...27 ²	NONE	
Trip Cct Fail 3 <i>Select which inputs block Trip Cct Fail 3 timer.</i>	NONE, 1...27 ²	NONE	
Trip Cct Fail 4 <i>Select which inputs block Trip Cct Fail 4 timer.</i>	NONE, 1...27 ²	NONE	
Trip Cct Fail 5 ¹ <i>Select which inputs block Trip Cct Fail 5 timer.</i>	NONE, 1...27 ²	NONE	
Trip Cct Fail 6 ¹ <i>Select which inputs block Trip Cct Fail 6 timer.</i>	NONE, 1...27 ²	NONE	
Trigger Wave Rec <i>Selects which inputs can trigger a waveform record</i>	NONE, 1...27 ²	NONE	
Trigger Data Rec <i>Selects which inputs can trigger a data record</i>	NONE, 1...27 ²	NONE	
Select Group 1 <i>Switches active setting group to group 1</i>	NONE, 1...27 ²	NONE	
Select Group 2 <i>Switches active setting group to group 2</i>	NONE, 1...27 ²	NONE	
Select Group 3 <i>Switches active setting group to group 3</i>	NONE, 1...27 ²	NONE	
Select Group 4 <i>Switches active setting group to group 4</i>	NONE, 1...27 ²	NONE	
Select Group 5	NONE, 1...27 ²	NONE	

Description	Range	Default	Setting
<i>Switches active setting group to group 5</i>			
Select Group 6 <i>Switches active setting group to group 6</i>	NONE, 1...27 ²	NONE	
Select Group 7 <i>Switches active setting group to group 7</i>	NONE, 1...27 ²	NONE	
Select Group 8 <i>Switches active setting group to group 8</i>	NONE, 1...27 ²	NONE	
Clock Sync. <i>Selects which input is used to synchronise the real time clock</i>	NONE, 1...27 ²	NONE	
Inverted Inputs <i>Selects which inputs pickup when voltage is removed, often used when monitoring trip circuits.</i>	NONE, 1...27 ²	NONE	

1) 3W Only.

2) 27 status inputs represents maximum configuration.

2.9 Status Input Timing Menu

Description	Range	Default	Setting
Aux I/P 1 Pickup Delay <i>Delay on pickup of DC Status input 1</i>	0.000,0.005...864000 s	0 s	
Aux I/P 1 Dropoff Delay <i>Delay on dropoff of DC Status input 1</i>	0.000,0.005...864000 s	0 s	
Aux I/P 2 Pickup Delay	0.000,0.005...864000 s	0 s	
Aux I/P 2 Dropoff Delay	0.000,0.005...864000 s	0 s	
Aux I/P 3 Pickup Delay	0.000,0.005...864000 s	0 s	
Aux I/P 3 Dropoff Delay	0.000,0.005...864000 s	0 s	
Aux I/P 4 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 4 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 5 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 5 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 6 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 6 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 7 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 7 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 8 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 8 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 9 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 9 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 10 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 10 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 11 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 11 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 12 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 12 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 13 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 13 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 14 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 14 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 15 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 15 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 16 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 16 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 17 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 17 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 18 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 18 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 19 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 19 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 20 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 20 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 21 Pickup Delay ¹	0.000,0.005...864000 s	0 s	

Description	Range	Default	Setting
Aux I/P 21 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 22 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 22 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 23 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 23 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 24 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 24 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 25 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 25 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 26 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 26 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 27 Pickup Delay ¹	0.000,0.005...864000 s	0 s	
Aux I/P 27 Dropoff Delay ¹	0.000,0.005...864000 s	0 s	

1) 27 status inputs represents maximum configuration.

2.10 Reylogic Element Menu

Description	Range	Default	Setting
Max Data Rec Time <i>When a data record is triggered by a fault condition the relay stops recording information when either the triggering condition is removed or this timer expires whichever happens first.</i>	0,1...60000 ms	2000 ms	

2.11 Output Relay Menu

Description	Range	Default	Setting
W1 51 <i>Winding 1 IDMTL Overcurrent operated</i>	NONE, 1...29 ¹	4,5	
W1 50 <i>Winding 1 DTL Overcurrent operated</i>	NONE, 1...29 ¹	4,5	
W1 51N <i>Winding 1 IDMTL derived Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
W1 50N <i>Winding 1 DTL derived Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
W1 87REF <i>Winding 1 High Impedance Restricted Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
W2 51 <i>Winding 2 IDMTL Overcurrent operated</i>	NONE, 1...29 ¹	4,5	
W2 50 <i>Winding 2 DTL Overcurrent operated</i>	NONE, 1...29 ¹	4,5	
W2 51N <i>Winding 2 IDMTL derived Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
W2 50N <i>Winding 2 DTL derived Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
W2 87REF <i>Winding 2 High Impedance Restricted Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
W3 51 ³ <i>Winding 3 IDMTL Overcurrent operated</i>	NONE, 1...29 ¹	4,5	
W3 50 ³ <i>Winding 3 DTL Overcurrent operated</i>	NONE, 1...29 ¹	4,5	
W3 51N ³ <i>Winding 3 IDMTL derived Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
W3 50N ³ <i>Winding 3 DTL derived Earth Fault operated</i>	NONE, 1...29 ¹	4,5	

Description	Range	Default	Setting
W3 87REF ³ <i>Winging 3 High Impedance Restricted Earth Fault operated</i>	NONE, 1...29 ¹	4,5	
87BD <i>Biased Differential operated</i>	NONE, 1...29 ¹	4,5	
87HS <i>Differential Highset operated</i>	NONE, 1...29 ¹	4,5	
Phase A <i>A phase A element operated</i>	NONE, 1...29 ¹	NONE	
Phase B <i>A phase B element operated</i>	NONE, 1...29 ¹	NONE	
Phase C <i>A phase C element operated</i>	NONE, 1...29 ¹	NONE	
Phase N <i>A phase N element operated</i>	NONE, 1...29 ¹	NONE	
General Starter <i>A starter element is picked up</i>	NONE, 1...29 ¹	NONE	
General Trip <i>An element has operated. Useful when testing individual functions!</i>	NONE, 1...29 ¹	NONE	
Trip Cct Fail 1 <i>Trip Circuit 1 has failed</i>	NONE, 1...29 ¹	NONE	
Trip Cct Fail 2 <i>Trip Circuit 2 has failed</i>	NONE, 1...29 ¹	NONE	
Trip Cct Fail 3 <i>Trip Circuit 3 has failed</i>	NONE, 1...29 ¹	NONE	
Trip Cct Fail 4 <i>Trip Circuit 4 has failed</i>	NONE, 1...29 ¹	NONE	
Trip Cct Fail 5 <i>Trip Circuit 5 has failed</i>	NONE, 1...29 ¹	NONE	
Trip Cct Fail 6 <i>Trip Circuit 6 has failed</i>	NONE, 1...29 ¹	NONE	
Trip Circuit Fail <i>A trip circuit has failed, look at status input Leds to find out which one</i>	NONE, 1...29 ¹	NONE	
New Wave Stored <i>The waveform recorder has stored new information Note: this is a pulsed output</i>	NONE, 1...29 ¹	NONE	
New Data Stored <i>The data recorder has stored new information Note: this is a pulsed output</i>	NONE, 1...29 ¹	NONE	
Aux I/P 1 Operated <i>DC Status 1 has operated</i>	NONE, 1...29 ¹	NONE	
Aux I/P 2 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 3 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 4 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 5 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 6 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 7 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 8 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 9 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 10 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 11 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 12 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 13 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 14 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 15 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 16 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 17 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 18 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 19 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 20 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 21 Operated	NONE, 1...29 ¹	NONE	

Description	Range	Default	Setting
Aux I/P 22 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 23 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 24 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 25 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 26 Operated	NONE, 1...29 ¹	NONE	
Aux I/P 27 Operated	NONE, 1...29 ¹	NONE	
Hand Reset Outputs <i>Relays selected, as Hand Reset will remain latched until manually reset from front panel or via communications link or by removing DC Supply. By default relays are Self Resetting and will reset when the driving signal is removed.</i>	NONE, 1...29 ¹	NONE	
Protection Healthy <i>Relays selected are energised whilst relay self-monitoring does NOT detect any hardware or software errors and DC Supply is healthy. A changeover contact or normally closed contact may be used to generate Protection Defective from this output</i>	NONE, 1...29 ¹	1	

1) 29 output relays represents maximum configuration.

2) Only when fitted.

3) 3W Only.

2.12 OP Relay Timing Menu

Description	Range	Default	Setting
Min Operate Time 1 <i>Minimum operate time of output relay 1</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 2 <i>Minimum operate time of output relay 2</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 3 <i>Minimum operate time of output relay 3</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 4 <i>Minimum operate time of output relay 4</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 5 <i>Minimum operate time of output relay 5</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 6 ¹ <i>Minimum operate time of output relay 6</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 7 ¹ <i>Minimum operate time of output relay 7</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 8 ¹ <i>Minimum operate time of output relay 8</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 9 ¹ <i>Minimum operate time of output relay 9</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 10 ¹ <i>Minimum operate time of output relay 10</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 11 ¹ <i>Minimum operate time of output relay 11</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 12 ¹ <i>Minimum operate time of output relay 12</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 13 ¹ <i>Minimum operate time of output relay 13</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 14 ¹ <i>Minimum operate time of output relay 14</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 15 ¹ <i>Minimum operate time of output relay 15</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 16 ¹ <i>Minimum operate time of output relay 16</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 17 ¹ <i>Minimum operate time of output relay 17</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 18 ¹ <i>Minimum operate time of output relay 18</i>	0.02, 0.04...60 s	0.1 s	

Description	Range	Default	Setting
Min Operate Time 19 ¹ <i>Minimum operate time of output relay 19</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 20 ¹ <i>Minimum operate time of output relay 20</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 21 ¹ <i>Minimum operate time of output relay 22</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 22 ¹ <i>Minimum operate time of output relay 22</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 23 ¹ <i>Minimum operate time of output relay 23</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 24 ¹ <i>Minimum operate time of output relay 24</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 25 ¹ <i>Minimum operate time of output relay 25</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 26 ¹ <i>Minimum operate time of output relay 26</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 27 ¹ <i>Minimum operate time of output relay 27</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 28 ¹ <i>Minimum operate time of output relay 28</i>	0.02, 0.04...60 s	0.1 s	
Min Operate Time 29 ¹ <i>Minimum operate time of output relay 29</i>	0.02, 0.04...60 s	0.1 s	

1) 29 output relays represents maximum configuration.

2.13 LED Menu

Description	Range	Default	Setting
W1 51 <i>Winding 1 IDMTL Overcurrent operated</i>	NONE, 1...32	5,22	
W1 50 <i>Winding 1 DTL Overcurrent operated</i>	NONE, 1...32	5,20	
W1 51N <i>Winding 1 IDMTL derived Earth Fault operated</i>	NONE, 1...32	5,23	
W1 50N <i>Winding 1 DTL derived Earth Fault operated</i>	NONE, 1...32	5,21	
W1 87REF <i>Winding 1 High Impedance Restricted Earth Fault operated</i>	NONE, 1...32	5,19	
W2 51 <i>Winding 2 IDMTL Overcurrent operated</i>	NONE, 1...32	6,22	
W2 50 <i>Winding 2 DTL Overcurrent operated</i>	NONE, 1...32	6,20	
W2 51N <i>Winding 2 IDMTL derived Earth Fault operated</i>	NONE, 1...32	6,23	
W2 50N <i>Winding 2 DTL derived Earth Fault operated</i>	NONE, 1...32	6,21	
W2 87REF <i>Winding 2 High Impedance Restricted Earth Fault operated</i>	NONE, 1...32	6,19	
W3 50 ² <i>Winding 3 DTL Overcurrent operated</i>	NONE, 1...32	6,20	
W3 51N ² <i>Winding 3 IDMTL derived Earth Fault operated</i>	NONE, 1...32	6,23	
W3 50N ² <i>Winding 3 DTL derived Earth Fault operated</i>	NONE, 1...32	6,21	
W3 87REF ² <i>Winding 3 High Impedance Restricted Earth Fault operated</i>	NONE, 1...32	6,19	

Description	Range	Default	Setting
87BD <i>Biased Differential operated</i>	NONE, 1...32	17	
87HS <i>Differential Highset operated</i>	NONE, 1...32	18	
Phase A <i>A phase A element operated</i>	NONE, 1...32	2	
Phase B <i>A phase B element operated</i>	NONE, 1...32	3	
Phase C <i>A phase C element operated</i>	NONE, 1...32	4	
Phase N <i>A phase N element operated</i>	NONE, 1...32	NONE	
General Starter <i>A starter element is picked up. Useful when testing individual functions!</i>	NONE, 1...32	1	
General Trip <i>An element has operated. Useful when testing individual functions!</i>	NONE, 1...32	1	
Trip Cct Fail 1 <i>Trip Circuit 1 has failed</i>	NONE, 1...32	NONE	
Trip Cct Fail 2 <i>Trip Circuit 2 has failed</i>	NONE, 1...32	NONE	
Trip Cct Fail 3 <i>Trip Circuit 3 has failed</i>	NONE, 1...32	NONE	
Trip Cct Fail 4 <i>Trip Circuit 4 has failed</i>	NONE, 1...32	NONE	
Trip Cct Fail 5 ² <i>Trip Circuit 5 has failed</i>	NONE, 1...32	NONE	
Trip Cct Fail 6 ² <i>Trip Circuit 6 has failed</i>	NONE, 1...32	NONE	
Trip Circuit Fail <i>A trip circuit has failed, look at status inputs Leds to find out which one</i>	NONE, 1...32	24	
New Data Stored <i>The waveform recorder has stored new information</i>	NONE, 1...32	NONE	
Aux I/P 1 Operated <i>DC Status 1 has operated</i>	NONE, 1...32	9	
Aux I/P 2 Operated	NONE, 1...32	10	
Aux I/P 3 Operated	NONE, 1...32	11	
Aux I/P 4 Operated ¹	NONE, 1...32	12	
Aux I/P 5 Operated ¹	NONE, 1...32	13	
Aux I/P 6 Operated ¹	NONE, 1...32	14	
Aux I/P 7 Operated ¹	NONE, 1...32	15	
Aux I/P 8 Operated ¹	NONE, 1...32	16	
Aux I/P 9 Operated ¹	NONE, 1...32	25	
Aux I/P 10 Operated ¹	NONE, 1...32	26	
Aux I/P 11 Operated ¹	NONE, 1...32	27	
Aux I/P 12 Operated ¹	NONE, 1...32	NONE	
Aux I/P 13 Operated ¹	NONE, 1...32	NONE	
Aux I/P 14 Operated ¹	NONE, 1...32	NONE	
Aux I/P 15 Operated ¹	NONE, 1...32	NONE	
Aux I/P 16 Operated ¹	NONE, 1...32	NONE	
Aux I/P 17 Operated ¹	NONE, 1...32	NONE	
Aux I/P 18 Operated ¹	NONE, 1...32	NONE	
Aux I/P 19 Operated ¹	NONE, 1...32	NONE	
Aux I/P 20 Operated ¹	NONE, 1...32	NONE	
Aux I/P 21 Operated ¹	NONE, 1...32	NONE	
Aux I/P 22 Operated ¹	NONE, 1...32	NONE	
Aux I/P 23 Operated ¹	NONE, 1...32	NONE	
Aux I/P 24 Operated ¹	NONE, 1...32	NONE	
Aux I/P 25 Operated ¹	NONE, 1...32	NONE	
Aux I/P 26 Operated ¹	NONE, 1...32	NONE	

Description	Range	Default	Setting
Aux I/P 27 Operated ¹	NONE, 1...32	NONE	
Self Reset LEDs <i>LEDs selected, as Self Reset will automatically reset when the driving signal is removed. By default all LEDs are Hand Reset and must be manually reset either locally via the front fascia or remotely via communications.</i>	NONE, 1...32	1	

1) Only when fitted.

2) 3W Only

2.14 Data Storage Menu

Description	Range	Default	Setting
Clear Faults	NO, YES	NO	
Clear Events	NO, YES	NO	
Pre-Trigger Storage	10...90 %	20 %	
Record Duration ¹	5 Recs x 1 Seconds, 2 Recs x 2 Seconds, 1 Recs x 5 Seconds	5 Recs x 1 Second	
Trigger Waveform	NO, YES	NO	
Clear Waveforms	NO, YES	NO	

1) Number of records and duration available is dependent upon relay model

2.15 Communications Menu

Description	Range	Default	Setting
Station Address <i>IEC 60870-5-103 Station Address</i>	0...254	0	
COM1 Protocol <i>Selects protocol to use for COM 1</i>	OFF, IEC60870-5-103, MODBUS-RTU	IEC60870-5-103	
COM1 Baud Rate <i>Sets the communications baud rate for com port 1 (Rear upper Fibre optic port)</i>	75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	19200	
COM1 Parity <i>Selects whether parity information is used</i>	Even, Odd, None	Even	
COM1 Line Idle <i>Selects the communications line idle sense</i>	Light Off, Light On	Light Off	
COM1 Data Echo <i>Enables echoing of data from RX port to TX port when operating relays in a Fibre Optic ring configuration</i>	Off, On	Off	
COM2 Protocol <i>Selects protocol to use for COM 2</i>	OFF, IEC60870-5-103, MODBUS-RTU, ASCII	ASCII	
COM2 Baud Rate <i>Sets the communications baud rate for com port 2 (Rear lower Fibre optic port AND Front Fascia RS232 port)</i>	75, 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	57600	
COM2 Parity <i>Selects whether parity information is used</i>	Even, Odd, None	Even	
COM2 Line Idle <i>Selects the communications line idle sense</i>	Light Off, Light On	Light Off	
COM2 Data Echo <i>Enables echoing of data from RX port to TX port when operating relays in a Fibre Optic ring configuration</i>	Off, On	Off	
COM2 Direction <i>Selects how Com2 is shared between the front fascia port and the rear fibre optic port. This allows interlocking to prevent remote access whilst an</i>	AUTO-DETECT, FRONT PORT, REAR PORT	AUTO-DETECT	

Description	Range	Default	Setting
<i>engineer is attached locally on site if IEC870 is on Com2 and Auto-detect is enabled</i>			

3 Instruments

INSTRUMENT	DESCRIPTION
[WINDING 1 METERS] --> press down <--	Start of Winding 1 meters
W1 Primary Currents 0.000 0.000 0.000 kA	Winding 1 primary currents
W1 Sec'y Currents 0.000 0.000 0.000 A	Winding 1 secondary currents
W1 Nom Currents 0.00 0.00 0.00 xIn	Winding 1 nominal currents
W1 Res Nom Current 0.00 xIn	Winding 1 residual nominal current
W1 51/51N Status 0 0 0 0 %	Operation progress meters for Winding 1 (51/51N) IDMTL elements, phases A, B, C and E/F
[W1 REF METERS] --> press down <--	Start of Winding 1 REF meters
W1 REF Pri'y Current 0.000 kA	Winding 1 REF primary current
W1 REF Sec'y Current 0.000 A	Winding 1 REF secondary current
W1 Nom Currents 0.00 xIn	Winding 1 REF nominal current
[WINDING 2 METERS] --> press down <--	Start of Winding 2 meters
W2 Primary Currents 0.000 0.000 0.000 kA	Winding 2 primary currents
W2 Sec'y Currents 0.000 0.000 0.000 A	Winding 2 secondary currents
W2 Nom Currents 0.00 0.00 0.00 xIn	Winding 2 nominal currents
W2 Residual Current 0.00 xIn	Winding 2 residual nominal current
W2 51/51N Status 0 0 0 0 %	Operation progress meters for Winding 2 (51/51N) IDMTL elements, phases A, B, C and E/F
[W2 REF METERS] --> press down <--	Start of Winding 2 REF meters
W2 REF Pri'y Current 0.000 kA	Winding 2 REF primary current
W2 REF Sec'y Current 0.000 A	Winding 2 REF secondary current
W2 Nom Currents 0.00 xIn	Winding 2 REF nominal current
[WINDING 3 METERS] --> press down <--	Start of Winding 3 meters ³
W3 Primary Currents 0.000 0.000 0.000 kA	Winding 3 primary currents ³
W3 Sec'y Currents 0.000 0.000 0.000 A	Winding 3 secondary currents ³
W3 Nom Currents 0.00 0.00 0.00 xIn	Winding 3 nominal currents ³
W3 Residual Current 0.00 xIn	Winding 3 residual nominal current ³
W3 51/51N Status 0 0 0 0 %	Operation progress meters for Winding 3 (51/51N) IDMTL elements, phases A, B, C and E/F ³
[W3 REF METERS] --> press down <--	Start of Winding 3 REF meters ³
W3 REF Pri'y Current 0.000 kA	WINDING 3 REF primary current ³
W3 REF Sec'y Current 0.000 A	WINDING 3 REF secondary current ³
W3 Nom Currents 0.00 xIn	WINDING 3 REF nominal current ³
[BIAS DIFF METERS] --> press down <--	Start of (87) Biased Differential meters

INSTRUMENT	DESCRIPTION
W1 Line Currents 0.00 0.00 0.00 xIn	Winding 1 measured currents
W2 Line Currents 0.00 0.00 0.00 xIn	Winding 2 measured currents
W3 Line Currents 0.00 0.00 0.00 xIn	Winding 3 measured currents ³
W1 Relay Currents 0.00 0.00 0.00 xIn	Winding 1 currents after Interposing CT correction factors applied
W2 Relay Currents 0.00 0.00 0.00 xIn	Winding 2 currents after Interposing CT correction factors applied
W3 Relay Currents 0.00 0.00 0.00 xIn	Winding 3 currents after Interposing CT correction factors applied ³
Operate Currents 0.00 0.00 0.00 xIn	Differential operate currents
Restrain Currents 0.00 0.00 0.00 xIn	Differential restrain currents
Mag Inrush Currents 0.00 0.00 0.00 xIn	Differential magnetising inrush currents (even harmonic content of operate currents but mainly 2 nd harmonic content)
[MISC METERS] --> press down <--	Start of miscellaneous meters
Status Inputs 1-16 -----	Displays the state of DC status inputs 1 to 16 ¹
Status Inputs 17-19 ---	Displays the state of DC status inputs 17 to 19 ¹
Output Relays 1-16 -----	Displays the state of output relays 1 to 16 ²
Output Relays 17-21 -----	Displays the state of output relays 17 to 21 ²
Time & Date 13/08/2002 10:16:11	Time and Date
Fault Records 0	Number of fault records stored
Event Records 0	Number of event records stored
Waveform Records 0	Number of waveform records stored

1) Display is different when fewer status inputs are fitted

2) Display is different when fewer output relays are fitted

3) 3 Winding only

4 IEC 60870-5-103 Communications Information

4.1 IEC 60870-5-103 Semantics in monitor direction

FUN	INF	Description	GI	TYP	COT
60	1	IEC870 Active Com1	x	1	1,9
60	2	IEC870 Active Com2	x	1	1,9
60	3	Front Port OverRide	x	1	1,9

FUN	INF	Description	GI	TYP	COT
176	0	GI End	-	8	10
176	0	Time Synchronisation	-	6	8
176	2	Reset FCB	-	2	3
176	3	Reset CU	-	2	4
176	4	Start/Restart	-	2	5
176	22	Settings changed	-	1	1
176	23	Setting G1 selected	x	1	1,9
176	24	Setting G2 selected	x	1	1,9
176	25	Setting G3 selected	x	1	1,9
176	26	Setting G4 selected	x	1	1,9
176	27	Status Input 1	x	1	1,9
176	28	Status Input 2	x	1	1,9
176	29	Status Input 3	x	1	1,9
176	30	Status Input 4	x	1	1,9
176	36	Trip Circuit Fail	x	1	1,9
176	64	Start/Pick-up L1	x	2	1,9
176	65	Start/Pick-up L2	x	2	1,9
176	66	Start/Pick-up L3	x	2	1,9
176	67	Start/Pick-up N	x	2	1,9
176	68	General Trip	-	2	1
176	69	Trip L1	-	2	1
176	70	Trip L2	-	2	1
176	71	Trip L3	-	2	1
176	84	General Start/Pick-up	x	2	1,9
178	7	Biased Differential	-	2	1
178	8	Differential Highset	-	2	1
178	9	W1 Restricted Earth Fault	-	2	1
178	10	W2 Restricted Earth Fault	-	2	1
178	12	W3 Restricted Earth Fault	-	2	1
178	16	W2 Phase Fault	-	2	1
178	34	W1 Phase Fault	-	2	1
178	35	W1 Residual Earth Fault	-	2	1
178	48	W2 Residual Earth Fault	-	2	1
178	79	W3 Residual Earth Fault	-	2	1
178	128	Cold Start	-	1	1
178	129	Warm Start	-	1	1
178	130	Re-Start	-	1	1
178	135	Trigger Storage	-	1	1
178	145	Status Input 5	x	1	1,9

FUN	INF	Description	GI	TYP	COT
178	146	Status Input 6	x	1	1,9
178	147	Status Input 7	x	1	1,9
178	148	Status Input 8	x	1	1,9
178	149	Status Input 9	x	1	1,9
178	150	Status Input 10	x	1	1,9
178	151	Status Input 11	x	1	1,9
178	152	Status Input 12	x	1	1,9
178	153	Status Input 13	x	1	1,9
178	154	Status Input 14	x	1	1,9
178	155	Status Input 15	x	1	1,9
178	156	Status Input 16	x	1	1,9
178	157	Status Input 17	x	1	1,9
178	158	Status Input 18	x	1	1,9
178	159	Status Input 19	x	1	1,9
178	160	Status Input 20	x	1	1,9
178	161	Status Input 21	x	1	1,9
178	162	Status Input 22	x	1	1,9
178	163	Status Input 23	x	1	1,9
178	164	Status Input 24	x	1	1,9
178	165	Status Input 25	x	1	1,9
178	166	Status Input 26	x	1	1,9
178	167	Status Input 27	x	1	1,9
178	181	Plant Control Relay 1	x	1	1,9
178	182	Plant Control Relay 2	x	1	1,9
178	183	Plant Control Relay 3	x	1	1,9
178	184	Plant Control Relay 4	x	1	1,9
178	185	Plant Control Relay 5	x	1	1,9
178	186	Plant Control Relay 6	x	1	1,9
178	187	Plant Control Relay 7	x	1	1,9
178	188	Plant Control Relay 8	x	1	1,9
178	189	Plant Control Relay 9	x	1	1,9
178	190	Plant Control Relay 10	x	1	1,9
178	191	Plant Control Relay 11	x	1	1,9
178	192	Plant Control Relay 12	x	1	1,9
178	193	Plant Control Relay 13	x	1	1,9
178	194	Plant Control Relay 14	x	1	1,9
178	195	Plant Control Relay 15	x	1	1,9
178	196	Plant Control Relay 16	x	1	1,9
178	197	Plant Control Relay 17	x	1	1,9
178	198	Plant Control Relay 18	x	1	1,9
178	199	Plant Control Relay 19	x	1	1,9
178	200	Plant Control Relay 20	x	1	1,9
178	201	Plant Control Relay 21	x	1	1,9
178	202	Plant Control Relay 22	x	1	1,9
178	203	Plant Control Relay 23	x	1	1,9
178	204	Plant Control Relay 24	x	1	1,9
178	205	Plant Control Relay 25	x	1	1,9
178	206	Plant Control Relay 26	x	1	1,9

FUN	INF	Description	GI	TYP	COT
178	207	Plant Control Relay 27	x	1	1,9
178	208	Plant Control Relay 28	x	1	1,9
178	209	Plant Control Relay 29	x	1	1,9
178	230	Measurand W1 I _{L1,2,3} W1 I _{L1} (2.4 x) W1 I _{L2} (2.4 x) W1 I _{L3} (2.4 x)	-	9	2
178	231	Measurand W2 I _{L1,2,3} W2 I _{L1} (2.4 x) W2 I _{L2} (2.4 x) W2 I _{L3} (2.4 x)	-	9	2
178	232	Measurand W3 I _{L1,2,3} W3 I _{L1} (2.4 x) W3 I _{L2} (2.4 x) W3 I _{L3} (2.4 x)	-	9	2

4.2 IEC 60870-5-103 Semantics in control direction

FUN	INF	Description	COM	TYP	COT
176	0	GI Initiation		7	9
176	0	Time Synchronisation		6	8
176	19	LED reset	ON	20	20
176	23	Settings Group 1 Select	ON	20	20
176	24	Settings Group 2 Select	ON	20	20
176	25	Settings Group 3 Select	ON	20	20
176	26	Settings Group 4 Select	ON	20	20
176	110	Settings Group 5 Select	ON	20	20
176	111	Settings Group 6 Select	ON	20	20
176	112	Settings Group 7 Select	ON	20	20
176	113	Settings Group 8 Select	ON	20	20

FUN	INF	Description	COM	TYP	COT
178	181	Energise Output Relay 1	ON	20	20
178	182	Energise Output Relay 2	ON	20	20
178	183	Energise Output Relay 3	ON	20	20
178	184	Energise Output Relay 4	ON	20	20
178	185	Energise Output Relay 5	ON	20	20
178	186	Energise Output Relay 6	ON	20	20
178	187	Energise Output Relay 7	ON	20	20
178	188	Energise Output Relay 8	ON	20	20
178	189	Energise Output Relay 9	ON	20	20
178	190	Energise Output Relay 10	ON	20	20
178	191	Energise Output Relay 11	ON	20	20
178	192	Energise Output Relay 12	ON	20	20
178	193	Energise Output Relay 13	ON	20	20
178	194	Energise Output Relay 14	ON	20	20
178	195	Energise Output Relay 15	ON	20	20
178	196	Energise Output Relay 16	ON	20	20
178	197	Energise Output Relay 17	ON	20	20
178	198	Energise Output Relay 18	ON	20	20
178	199	Energise Output Relay 19	ON	20	20
178	200	Energise Output Relay 20	ON	20	20
178	201	Energise Output Relay 21	ON	20	20
178	202	Energise Output Relay 22	ON	20	20
178	203	Energise Output Relay 23	ON	20	20
178	204	Energise Output Relay 24	ON	20	20
178	205	Energise Output Relay 25	ON	20	20
178	206	Energise Output Relay 26	ON	20	20
178	207	Energise Output Relay 27	ON	20	20
178	208	Energise Output Relay 28	ON	20	20
178	209	Energise Output Relay 29	ON	20	20

5 MODBUS Semantics

5.1 Coils (0xxxx)

Address	Description
00001	Energise O/P Relay 1
00002	Energise O/P Relay 2
00003	Energise O/P Relay 3
00004	Energise O/P Relay 4
00005	Energise O/P Relay 5
00006	Energise O/P Relay 6
00007	Energise O/P Relay 7
00008	Energise O/P Relay 8
00009	Energise O/P Relay 9
00010	Energise O/P Relay 10
00011	Energise O/P Relay 11
00012	Energise O/P Relay 12
00013	Energise O/P Relay 13
00014	Energise O/P Relay 14
00015	Energise O/P Relay 15
00016	Energise O/P Relay 16
00017	Energise O/P Relay 17
00018	Energise O/P Relay 18
00019	Energise O/P Relay 19
00020	Energise O/P Relay 20
00021	Energise O/P Relay 21
00022	Energise O/P Relay 22
00023	Energise O/P Relay 23
00024	Energise O/P Relay 24
00025	Energise O/P Relay 25
00026	Energise O/P Relay 26
00027	Energise O/P Relay 27
00028	Energise O/P Relay 28
00029	Energise O/P Relay 29
00101	Settings Group 1
00102	Settings Group 2
00103	Settings Group 3
00104	Settings Group 4
00105	Settings Group 5
00106	Settings Group 6
00107	Settings Group 7
00108	Settings Group 8

5.2 Input Status (1xxxx)

Address	Description
10001	Status Input 1
10002	Status Input 2
10003	Status Input 3
10004	Status Input 4
10005	Status Input 5
10006	Status Input 6
10007	Status Input 7
10008	Status Input 8
10009	Status Input 9
10010	Status Input 10
10011	Status Input 11
10012	Status Input 12
10013	Status Input 13
10014	Status Input 14
10015	Status Input 15
10016	Status Input 16

Address	Description
10017	Status Input 17
10018	Status Input 18
10019	Status Input 19
10020	Status Input 20
10021	Status Input 21

Address	Description
10101	General Starter
10102	General Trip
10103	Phase A Starter
10104	Phase B Starter
10105	Phase C Starter
10106	Phase N Starter
10107	Phase A Trip
10108	Phase B Trip
10109	Phase C Trip
10110	Phase N Trip
10111	TCSAlarmOutput

Address	Description
10120	Relay Mode LOCAL
10121	Relay Mode REMOTE
10122	Relay Mode SERVICE

Address	Description
10130	Trip Cct Fail 1
10131	Trip Cct Fail 2
10132	Trip Cct Fail 3
10133	Trip Cct Fail 4
10134	Trip Cct Fail 5
10135	Trip Cct Fail 6

Address	Description
10200	87 Differential Phase A
10201	87 Differential Phase B
10202	87 Differential Phase C
10203	87HD Phase A Inhibited
10204	87HD Phase B Inhibited
10205	87HD Phase C Inhibited
10206	87 Trip
10207	87HS Differential Phase A
10208	87HS Differential Phase B
10209	87HS Differential Phase C
10210	87HS Trip

Address	Description
11100	W1 51 Starter A
11101	W1 51 Starter B
11102	W1 51 Starter C
11103	W1 51 Operated A
11104	W1 51 Operated B
11105	W1 51 Operated C
11106	W1 51 Trip
11107	W1 50 Starter A
11108	W1 50 Starter B
11109	W1 50 Starter C
11110	W1 50 Operated A
11111	W1 50 Operated B
11112	W1 50 Operated C
11113	W1 50 Trip
11114	W1 51N Starter
11115	W1 51N Operated
11116	W1 51N Trip

Address	Description
11117	W1 50N Starter
11118	W1 50N Operated
11119	W1 50N Trip

Address	Description
11150	W1 87REF Starter
11151	W1 87REF Operated
11152	W1 87REF Trip

Address	Description
11200	W2 51 Starter A
11201	W2 51 Starter B
11202	W2 51 Starter C
11203	W2 51 Operated A
11204	W2 51 Operated B
11205	W2 51 Operated C
11206	W2 51 Trip
11207	W2 50 Starter A
11208	W2 50 Starter B
11209	W2 50 Starter C
11210	W2 50 Operated A
11211	W2 50 Operated B
11212	W2 50 Operated C
11213	W2 50 Trip
11214	W2 51N Starter
11215	W2 51N Operated
11216	W2 51N Trip
11217	W2 50N Starter
11218	W2 50N Operated
11219	W2 50N Trip

Address	Description
11250	W2 87REF Starter
11251	W2 87REF Operated
11252	W2 87REF Trip

Address	Description
11300	W3 51 Starter A
11301	W3 51 Starter B
11302	W3 51 Starter C
11303	W3 51 Operated A
11304	W3 51 Operated B
11305	W3 51 Operated C
11306	W3 51 Trip
11307	W3 50 Starter A
11308	W3 50 Starter B
11309	W3 50 Starter C
11310	W3 50 Operated A
11311	W3 50 Operated B
11312	W3 50 Operated C
11313	W3 50 Trip
11314	W3 51N Starter
11315	W3 51N Operated
11316	W3 51N Trip
11317	W3 50N Starter
11318	W3 50N Operated
11319	W3 50N Trip

Address	Description
11350	W3 87REF Starter
11351	W3 87REF Operated
11352	W3 87REF Trip

5.3 Input Registers (3xxxx)

Address	Description	Format
30001	No. of Events In Store (See 434/TIR/15)	1 Register
30002	Latest Event Record (See 434/TIR/15)	8 Registers

Address	Description	Format
30010	Number of fault records	UINT16 ²
30012	Number of event records	UINT16 ²
30014	Number of waveform records	UINT16 ²
30016	Number of CPU re-starts	UINT16 ²
30018	Number of CPU warm starts	UINT16 ²

Address	Description	Format
30100	Operate Current Ia x In	FP_32BITS_3DP ¹
30102	Operate Current Ib x In	FP_32BITS_3DP ¹
30104	Operate Current Ic x In	FP_32BITS_3DP ¹
30106	Restrain Current Ia x In	FP_32BITS_3DP ¹
30108	Restrain Current Ib x In	FP_32BITS_3DP ¹
30110	Restrain Current Ic x In	FP_32BITS_3DP ¹
30112	Mag Inrush Current Ia x In	FP_32BITS_3DP ¹
30114	Mag Inrush Current Ib x In	FP_32BITS_3DP ¹
30116	Mag Inrush Current Ic x In	FP_32BITS_3DP ¹

Address	Description	Format
31100	W1 Primary Ia kA	FP_32BITS_3DP ¹
31102	W1 Primary Ib kA	FP_32BITS_3DP ¹
31104	W1 Primary Ic kA	FP_32BITS_3DP ¹
31106	W1 Sec'y Ia A	FP_32BITS_3DP ¹
31108	W1 Sec'y Ib A	FP_32BITS_3DP ¹
31110	W1 Sec'y Ic A	FP_32BITS_3DP ¹
31112	W1 Nom Ia xIn	FP_32BITS_3DP ¹
31114	W1 Nom Ib xIn	FP_32BITS_3DP ¹
31116	W1 Nom Ic xIn	FP_32BITS_3DP ¹
31118	W1 Line Ia xIn	FP_32BITS_3DP ¹
31120	W1 Line Ib xIn	FP_32BITS_3DP ¹
31122	W1 Line Ic xIn	FP_32BITS_3DP ¹
31124	W1 Relay Ia xIn	FP_32BITS_3DP ¹
31126	W1 Relay Ib xIn	FP_32BITS_3DP ¹
31128	W1 Relay Ic xIn	FP_32BITS_3DP ¹
31130	W1 REF Pri'y Current	FP_32BITS_3DP ¹
31132	W1 REF Sec'y Current	FP_32BITS_3DP ¹
31134	W1 REF Nom Current	FP_32BITS_3DP ¹
31136	W1 51 Phase A Status (0-100%)	UINT16
31137	W1 51 Phase B Status (0-100%)	UINT16
31138	W1 51 Phase C Status (0-100%)	UINT16
31139	W1 51 Phase N Status (0-100%)	UINT16

Address	Description	Format
31200	W2 Primary Ia kA	FP_32BITS_3DP ¹
31202	W2 Primary Ib kA	FP_32BITS_3DP ¹
31204	W2 Primary Ic kA	FP_32BITS_3DP ¹
31206	W2 Sec'y Ia A	FP_32BITS_3DP ¹
31208	W2 Sec'y Ib A	FP_32BITS_3DP ¹
31210	W2 Sec'y Ic A	FP_32BITS_3DP ¹
31212	W2 Nom Ia xIn	FP_32BITS_3DP ¹
31214	W2 Nom Ib xIn	FP_32BITS_3DP ¹
31216	W2 Nom Ic xIn	FP_32BITS_3DP ¹
31218	W3 Line Ia xIn	FP_32BITS_3DP ¹
31220	W2 Line Ib xIn	FP_32BITS_3DP ¹
31222	W2 Line Ic xIn	FP_32BITS_3DP ¹
31224	W2 Relay Ia xIn	FP_32BITS_3DP ¹

Address	Description	Format
31226	W2 Relay Ib xIn	FP_32BITS_3DP ¹
31228	W2 Relay Ic xIn	FP_32BITS_3DP ¹
31230	W2 REF Pri'y Current	FP_32BITS_3DP ¹
31232	W2 REF Sec'y Current	FP_32BITS_3DP ¹
31234	W2 REF Nom Current	FP_32BITS_3DP ¹
31236	W2 51 Phase A Status (0-100%)	UINT16
31237	W2 51 Phase B Status (0-100%)	UINT16
31238	W2 51 Phase C Status (0-100%)	UINT16
31239	W2 51 Phase N Status (0-100%)	UINT16

Address	Description	Format
31300	W3 Primary Ia kA	FP_32BITS_3DP ¹
31302	W3 Primary Ib kA	FP_32BITS_3DP ¹
31304	W3 Primary Ic kA	FP_32BITS_3DP ¹
31306	W3 Sec'y Ia A	FP_32BITS_3DP ¹
31308	W3 Sec'y Ib A	FP_32BITS_3DP ¹
31310	W3 Sec'y Ic A	FP_32BITS_3DP ¹
31312	W3 Nom Ia xIn	FP_32BITS_3DP ¹
31314	W3 Nom Ib xIn	FP_32BITS_3DP ¹
31316	W3 Nom Ic xIn	FP_32BITS_3DP ¹
31318	W3 Line Ia xIn	FP_32BITS_3DP ¹
31320	W3 Line Ib xIn	FP_32BITS_3DP ¹
31322	W3 Line Ic xIn	FP_32BITS_3DP ¹
31324	W3 Relay Ia xIn	FP_32BITS_3DP ¹
31326	W3 Relay Ib xIn	FP_32BITS_3DP ¹
31328	W3 Relay Ic xIn	FP_32BITS_3DP ¹
31330	W3 REF Pri'y Current	FP_32BITS_3DP ¹
31332	W3 REF Sec'y Current	FP_32BITS_3DP ¹
31334	W3 REF Nom Current	FP_32BITS_3DP ¹
31336	W3 51 Phase A Status (0-100%)	UINT16
31337	W3 51 Phase B Status (0-100%)	UINT16
31338	W3 51 Phase C Status (0-100%)	UINT16
31339	W3 51 Phase N Status (0-100%)	UINT16

1) FP_32BITS_3DP: 2 registers - 32 bit fixed point, a 32 bit integer containing a value to 3 decimal places e.g. 50000 sent = 50.000

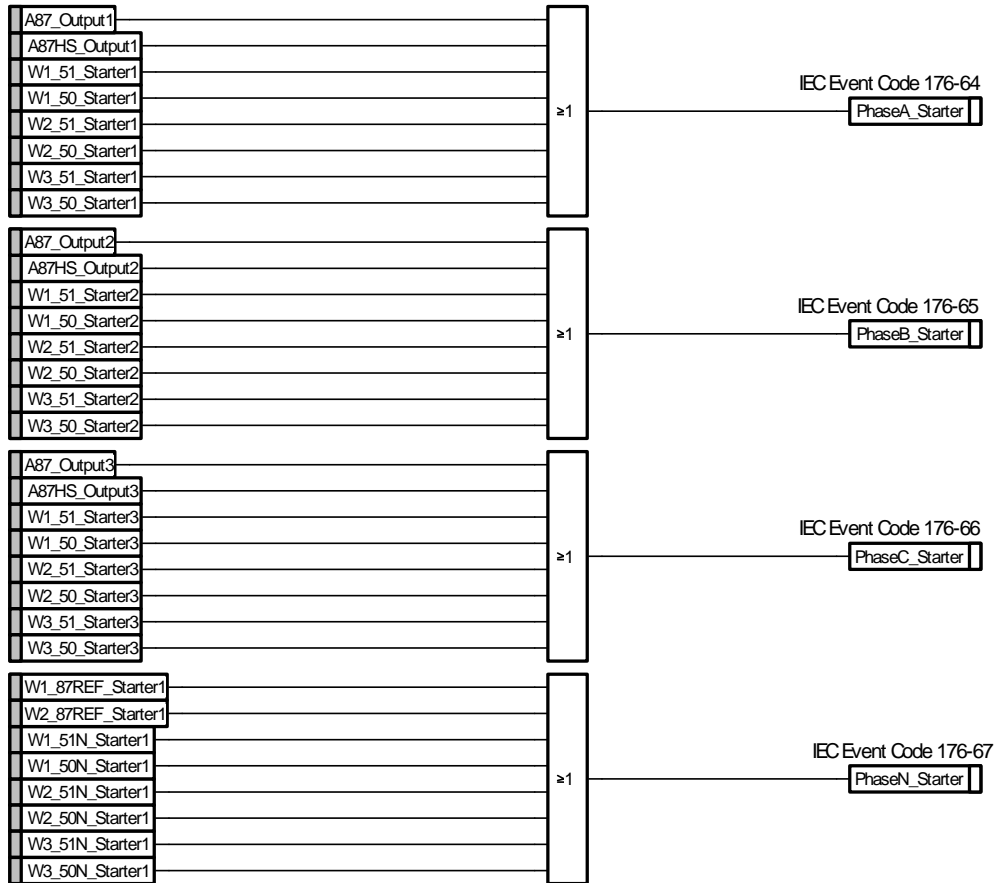
2) UINT16: 1 register - standard 16 bit unsigned integer

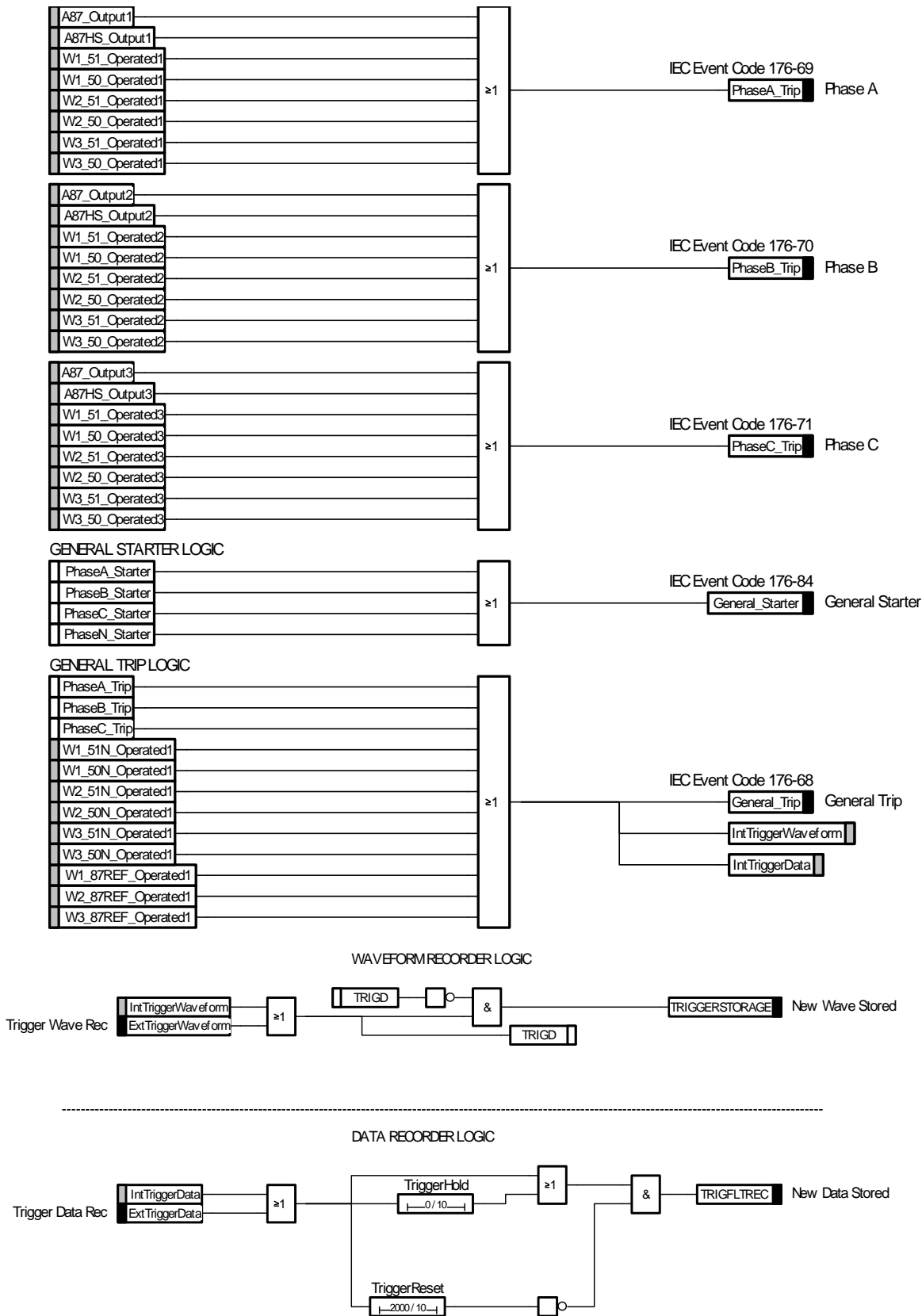
5.4 Holding Registers (4xxxx)

Address	Description	Format
40001	Time	

6 Reylogic Diagrams

OVERALL PHASE SELECTION LOGIC





INPUTS TO SELECT A SETTING GROUP FROM A STATUS INPUT.

Select Group 1	SiSelectGroup1_Input	SiSelectSettingGroup1
Select Group 2	SiSelectGroup2_Input	SiSelectSettingGroup2
Select Group 3	SiSelectGroup3_Input	SiSelectSettingGroup3
Select Group 4	SiSelectGroup4_Input	SiSelectSettingGroup4
Select Group 5	SiSelectGroup5_Input	SiSelectSettingGroup5
Select Group 6	SiSelectGroup6_Input	SiSelectSettingGroup6
Select Group 7	SiSelectGroup7_Input	SiSelectSettingGroup7
Select Group 8	SiSelectGroup8_Input	SiSelectSettingGroup8

7 Label Inserts

	DUOBIAS-M-201-2W-R15
	3i5o in E8 Case
	DU3-203-*A
	09/02/2010 09:38:00
1	GENERAL STARTER
2	PHASE A
3	PHASE B
4	PHASE C
5	WDG1
6	WDG2
7	(87) BIAS. DIFFERENTIAL
8	(87HS) DIFF. HIGHSET
9	(87REF) RESTRICTED E/F
10	(50/51) O/C
11	(50N/51N) DERIVED E/F
12	(74TC) TRIP CIRCUIT FAIL
13	
14	<i>AUX 1 I/P OPERATED</i>
15	<i>AUX 2 I/P OPERATED</i>
16	<i>AUX 3 I/P OPERATED</i>

	DUOBIAS-M-201-2W-R15	DUOBIAS-M-201-2W-R15	
	DU3-203-**	DU3-203-**	
	Left	Right	
	09/02/2010 09:38:00	09/02/2010 09:38:00	
1	GENERAL STARTER	(87) BIAS. DIFFERENTIAL	17
2	PHASE A	(87HS) DIFF. HIGHSET	18
3	PHASE B	(87REF) RESTRICTED E/F	19
4	PHASE C	(50) O/C	20
5	WDG1	(50N) DERIVED E/F	21
6	WDG2	(51) O/C	22
7		(51N) DERIVED E/F	23
8		(74TC) TRIP CIRCUIT FAIL	24
9	<i>AUX 1 I/P OPERATED</i>	<i>AUX 9 I/P OPERATED</i>	25
10	<i>AUX 2 I/P OPERATED</i>	<i>AUX 10 I/P OPERATED</i>	26
11	<i>AUX 3 I/P OPERATED</i>	<i>AUX 11 I/P OPERATED</i>	27
12	<i>AUX 4 I/P OPERATED</i>		28
13	<i>AUX 5 I/P OPERATED</i>		29
14	<i>AUX 6 I/P OPERATED</i>		30
15	<i>AUX 7 I/P OPERATED</i>		31
16	<i>AUX 8 I/P OPERATED</i>		32

	DUOBIAS-M-201-3W-R15	DUOBIAS-M-201-3W-R15	
	DU3-303-**	DU3-303-**	
	Left	Right	
	09/02/2010 09:38:00	09/02/2010 09:38:00	
1	GENERAL STARTER	(87) BIAS. DIFFERENTIAL	17
2	PHASE A	(87HS) DIFF. HIGHSET	18
3	PHASE B	(87REF) RESTRICTED E/F	19
4	PHASE C	(50) O/C	20
5	WDG1	(50N) DERIVED E/F	21
6	WDG2	(51) O/C	22
7	WDG3	(51N) DERIVED E/F	23
8		(74TC) TRIP CIRCUIT FAIL	24
9	<i>AUX 1 I/P OPERATED</i>	<i>AUX 9 I/P OPERATED</i>	25
10	<i>AUX 2 I/P OPERATED</i>	<i>AUX 10 I/P OPERATED</i>	26
11	<i>AUX 3 I/P OPERATED</i>	<i>AUX 11 I/P OPERATED</i>	27
12	<i>AUX 4 I/P OPERATED</i>		28
13	<i>AUX 5 I/P OPERATED</i>		29
14	<i>AUX 6 I/P OPERATED</i>		30
15	<i>AUX 7 I/P OPERATED</i>		31
16	<i>AUX 8 I/P OPERATED</i>		32