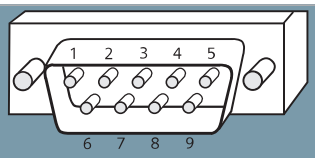
Integration into Supervisory Systems

WL Circuit Breaker



Pin 1 - Common
Pin 5 - B, Tx/Rx +
Pin 9 - A, Tx/Rx –

Graphic 4-2

Default Communication Parameters

The COM16 comes set-up with the following default Communication Parameters:

Baud: 19,200 Unit ID: 126 Parity: Even

Graphic 4-3

Data formatting byte order

Data points larger than two bytes are transmitted in the Motorola Format (Big-Endian)

Byte order			Type of data
Byte 0 Byte 1	Byte 0 Byte 1		char, unsigned char
Byte 0 Byte 1	High byte Low byte		signed int, unsigned int
Byte 0 Byte 1	High byte Low byte	High word	signed long, unsigned long
Byte 2 Byte 3	High byte Low byte	Low word	

COM16 Supported Function Codes

Function 01: Read Coils

Function	This function reads the state of multiple Control Bits and Extra Flags in a COM16 slave.
Bit Start Address	Any value from 0000 hex to 000F hex. If any other address is specified, an Exception Code of 02 (Invalid Data Address) will be returned.
Quantity of Bits	If "Quantity of Bits" is not in the range of 1 to 16, an Exception Code of 03 (Invalid Data Value) will be returned. If an attempt to read a bit beyond Bit Address 000F hex is made, an Exception Code of 02 (Invalid Data Address) will be returned.

Function 02: Read Discrete Inputs

Function	This function reads the state of the bits in the Status Register in a COM16 slave.
Bit Start Address	Any value from 0000 hex to 000F hex. If any other address is specified, an Exception Code of 02 (Invalid Data Address) will be returned.
Quantity of Bits	If "Quantity of Bits" is not in the range of 1 to 16, an Exception Code of 03 (Invalid Data Value) will be returned. If an attempt to read a bit beyond Bit Address 000F hex is made, an Exception Code of 02 (Invalid Data Address) will be returned.

Function 03: Read Holding Registers

Function	This function reads a set of registers from a COM16 slave.
Start Address	Any value within the address range defined for each of the data sets. If any other address is specified, an Exception Code of 02 (Invalid Data Address) will be returned.
Quantity of Registers	If "Quantity of Registers" is not in the range of 1 to 125, an Exception Code of 03 (Invalid Data Value) will be returned. If the "Quantity of Registers" is not correct for the Dataset indicated by the "Start Address", an Exception Code of 02 (Invalid Data Address) will be returned.

Example:

Request Message to slave

The following is an example of a request to read Dataset 0 from a COM16 slave device at MODBUS address 7. The length of Dataset 0 is 4 bytes.

07H Slave Address
03H Function Code
00H Register Start Address "High" (Dataset 0 address is 0000 hex)
b7H Register Start Address "Low"
00H Quantity of Registers "High" (Register quantity is 4 decimal)
04H Quantity of Registers "Low"
xxH CRC Check Code "Low"
xxH CRC Check Code "High"

Reply Message from slave

The response returns 2 registers containing the contents of Dataset 0.

07H Slave Address
03H Function Code
04H Byte Count (Bytes returned is 4)
00H Register Address 00H Data "High"
03H Register Address 00H Data "Low"
00H Register Address 00H Data "High"
00H Register Address 01H Data "Low"
xxH CRC Check Code "Low"
xxH CRC Check Code "High"

Integration into Supervisory Systems

WL Circuit Breaker

Function 04: Read Input Registers

Function	This function reads the Basic Data Registers from a COM16 slave. All three Basic Types (1, 2 and 3) are supported. (see pages 4/11 and 4/12 for Basic Data)
Start Address	Any Data Block register address that is valid for the currently selected Basic Type. If any other address is specified, an Exception Code of 02 (Invalid Data Address) will be returned.
Quantity of Registers	If "Quantity of Registers" is not in the range of 1 to 125, an Exception Code of 03 (Invalid Data Value) will be returned. If the "Quantity of Registers" specified attempts to read beyond the last register of the currently selected Basic Type, an Exception Code 02 (Invalid Data Address) will be returned.

Function 05: Write Single Coil

Function	This function sets the state of a single Control bit or Extra flag in a COM16 slave.
Bit Address	Any value from 0000 hex to 000F hex. If any other address is specified, an Exception Code of 02 (Invalid Data Address) will be returned.
Bit status	The following two values are valid as the Bit Status: FF00H set bit 0000H clear bit If any other value is specified, an Exception Code of 03 (Invalid Data Value) will be returned.

Function 07: Read Exception Status

Function	This function reads the state of eight Exception Status bits from the COM16 slave. The bits are defined in Table 3-1.

Bit Number	WL
0	Set = Inspect breaker contacts*
1	Set = Communication with trip unit is OK
2	Set = COM16 is OK
3	not defined, always zero
4	not defined, always zero
5	not defined, always zero
6	not defined, always zero
7	not defined, always zero

Table 4-1

*Refer to the Operator's Manual for proper procedure (only for WL ANSI / UL 1066 version).

Function 08: Diagnostics

Function	This function provides a method for checking the communication between the master and a COM16 slave. COM16 slaves support the diagnostic sub-functions Return Query Data (0000 hex) and Clear Event Counter (000A hex).
Diagnostic Code	0000 hex: Echoes the test data sent by the master. 000A hex: Clears the COM16 slave's communications counters. (The data field for both Request and Reply is set to 0000 hex.) If any other value is specified, an Exception Code of 03 (Invalid Data Value) will be returned.

Function 11: Get Communication Event Counter

Function	Returns a status word and an event count from the COM16 slave's communications event counter. The event counter is incremented once for each successful message completion. It is not incremented for exception responses or Fetch Communication Event Counter commands. The event counter can be reset by means of the Diagnostics function (code 08), with the sub-function Clear Counters (code 000A hex). The normal response contains a two-byte status word, and a two-byte event count. The status word will be all ones (FFFF hex) if the COM16 slave is still processing a previously issued program command (a busy condition exists). Otherwise, the status word will be all zeros.

Function 12: Get Communication Event Log

Function	Returns a status word, event count, message count and a field of event bytes from the slave. The status word and event count are identical to that returned by Function 11 (Fetch Communications Event Counter). The message counter is incremented once for each message processed by the slave. The event bytes field contains 64 bytes, with each byte corresponding to the status of one MODBUS send or receive operation for the slave. The slave enters the events into the field in chronological order. Byte 1 is the most recent event. Each new byte flushes the oldest byte from the field. The normal response contains a two-byte Status field, a two-byte Event Count field, a two-byte Message Count field and a 64 byte Event Byte field. The Byte Count contains the total number of bytes in these four fields.

Integration into Supervisory Systems
WL Circuit Breaker

What the Event Bytes Contain
For a COM16 slave, an event byte returned by the Fetch Communications Event Log function can be either of two types. The type is defined by bit 7 (the high–order bit) in each byte.

COM16 slave Receive Event
The slave stores this type of event byte when a query message is received. It is stored before the slave processes the message. This event is defined by bit 7 set to a logic "1". The other bits will be set to a logic "1" if the corresponding condition is TRUE. The bit layout is:

Bit	Contents
0	Not Used
1	Communications Error
2	Not Used
3	Not Used
4	Character Overrun
5	Currently in Listen Only Mode (always zero, the COM16 does not support Listen Only Mode)
6	Broadcast Received
7	1

Table 4-2

COM16 slave Send Event
The slave stores this type of event byte when it finishes processing a query message. It is stored if the slave returned a normal or exception response, or no response. This event is defined by bit 7 set to a logic "0", with bit 6 set to a "1". The other bits will be set to a logic "1" if the corresponding condition is TRUE.

The bit layout is:

Bit	Contents
0	Read Exception Sent (Exception Codes 1-3)
1	Slave Abort Exception Sent (Exception Code 4)
2	Slave Busy Exception Sent (Exception Codes 5-6)
3	Slave Program NAK Exception Sent (Exception Code 7)
4	Write Timeout Error Occurred
5	Currently in Listen Only Mode (always zero, the COM16 does not support Listen Only Mode)
6	1
7	0

Table 4-3

Supported Function Codes
WL Circuit Breaker

Function 15: Write Multiple Coils

Function	This function sets the state of multiple control bits and extra flags in a COM16 slave.
Bit Start Address	Any value from 0000 hex to 000F hex. If any other address is specified, an Exception Code of 02 (Invalid Data Address) will be returned.
Quantity of Bits	If "Quantity of Bits" is not in the range of 1 to 16, an Exception Code of 03 (Invalid Data Value) will be returned. If an attempt to write a bit beyond Bit Address 000F hex is made, an Exception Code of 02 (Invalid Data Address) will be returned.
Byte Count	This is the "Quantity of Bits" / 8. If the division remainder is non-zero, then 1 is added to "Byte Count". If "Byte Count" is incorrect, an Exception Code of 03 (Invalid Data Value) is returned. The following is an example of a request to set the state of six extra flags in a COM16 slave device at MODBUS address 7. Attempts to change unused bits will have no effect. Setting the indicated bits would: Clear Logs, Clear Min./Max., Clear Counters and Sync Time Stamp. Bit: 10 11 12 13 14 15 State: 1 1 0 0 1 1 The data contents are one byte: 33 hex (0011 0011 binary). The binary bits correspond in the following way: The byte transmitted (33 hex) addresses bits 10 ... 15, with the least significant bit addressing the lowest bit (10) in this set. The unused bits are zero-filled. The response returns the slave address, function code, starting address and Quantity of Bits written.

Supported Function Codes

WL Circuit Breaker

Function 16: Write Multiple Registers

Function	This function writes a complete Dataset to a COM16 slave.
Start Address	Any value within the address range defined for each of the data sets. If any other address is specified, an Exception Code of 02 (Invalid Data Address) will be returned.
Quantity of Registers	If "Quantity of Registers" is not in the range of 1 to 125, an Exception Code of 03 (Invalid Data Value) will be returned. If the "Quantity of Registers" is not correct for the Dataset indicated by the "Start Address", an Exception Code of 02 (Invalid Data Address) will be returned.

Example:

Request Message to slave

The following is an example of a write of Dataset 93 (Control Metering/Trip Unit) to a COM11/COM16 slave device at Modbus address 7. Some Datasets, such as Dataset 93, do not end on an even word boundary. For these Datasets an extra 0 filled byte is added to the end of the Dataset for both reads and writes.

07H Slave Address
10H Function Code (16 decimal)
5DH Register Start Address "High" (Dataset 93 address is 5D00 hex)
00H Register Start Address "Low"
00H Quantity of Registers "High"
0EH Quantity of Registers "Low" (14 decimal)
1CH Byte Count (28 decimal)
00H Register Address 5DH Data "High"
00H Register Address 00H Data "Low"
.
.
.
00H Register Address 5DH Data "High"
00H Register Address 1AH Data "Low"
xxH CRC Check Code "Low"
xxH CRC Check Code "High"

Reply Message from slave

The response returns the Start Address and the number of registers written.

07H Slave Address
10H Function Code (16 decimal)
5DH Register Start Address "High" (Dataset 93 address is 5D00 hex)
00H Register Start Address "Low"
00H Quantity of Registers "High"
0EH Quantity of Registers "Low" (14 decimal)
xxH CRC Check Code "Low"
xxH CRC Check Code "High"

Exception Responses
WL Circuit Breaker

Except for broadcast messages, when a master device sends a query to a slave device, it expects a normal response. One of four possible events can occur from the master's query:

1. If the slave device receives the query without a communication error, and can handle the query normally, it returns a normal response.

2. If the slave does not receive the query due to a communication error, no response is returned. The master program will eventually process a timeout condition for the query.

3. If the slave receives the query, but detects a communication error (parity or CRC), no response is returned. The master program will eventually process a timeout condition for the query.

4. If the slave receives the query without a communication error, but cannot handle it (for example, if the request is to read a non-existent coil or register), the slave will return an exception response informing the master of the nature of the error.

The exception response message has two fields that differentiate it from a normal response:
Function Code Field: In a normal response, the slave echoes the function code of the original query in the function code field of the response. All function codes a most-significant bit (MSB) of 0 (their values are all below 80 hex). In an exception response, the slave sets the MSB of the function code to 1 (adds 80 hex to the function code). With the function code's MSB set, the master's application program can recognize the exception response and can examine the data field for the exception code.

Data Field: In a normal response, the slave may return data or statistics in the data field (any information that was requested in the query). In an exception response, the slave returns an exception code in the data field. This defines the slave condition that caused the exception.

Example: Request Message to slave
The following is an example of a request to read Dataset 1 (Diagnostic Information) from a COM16 slave device at MODBUS address 7. Dataset 1 has 8 registers, but in this example, the Master tries to read just 6 registers.

07H	Slave Address
03H	Function Code
01H	Register Start Address “High” (Dataset 1 address is 0100 hex)
00H	Register Start Address “Low”
00H	Quantity of Registers “High”
06H	Quantity of Registers “Low” (6 registers is not valid)
xxH	CRC Check Code “Low”
xxH	CRC Check Code “High”

Reply Message from slave
The response returns the function code with the high bit set indicating an exception response. The Exception Code returned is 03 (Invalid Data Value). This exception code indicates that an illegal amount of data was specified for the requested Dataset.

07H	Slave Address
83H	Function Code
03H	Exception Code (Illegal Register Amount)
xxH	CRC Check Code “Low”
xxH	CRC Check Code “High”

Exception Responses

WL Circuit Break

Exception Codes		
Code	**Name**	**Meaning**
01 hex	Illegal Function	The function code received in the query is not an allowable action for the COM16 slave. If a Poll Program Complete command was issued, this code indicates that no program function preceded it.
02 hex	Illegal Data Address	The data address received in the query is not an allowable address for the COM16 slave.
03 hex	Illegal Data Value	A value contained in the query data field is not an allowable value for the COM16 slave.
04 hex	Slave Device Failure	An unrecoverable error occurred while the COM16 slave was attempting to perform the requested action.
05 hex	Acknowledge	The COM16 slave has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the master. The master can next issue a Poll Program Complete message to determine if processing is completed.
06 hex	Slave Device Busy	The COM16 slave is still busy processing the previous request. The master should re-transmit the message later when the COM16 slave is free.
07 hex	Negative Acknowledge	This code is returned for an unsuccessful programming request using function code 13 or 14 decimal. The COM16 slave will never return this exception response since it does not support function 13 or 14.
08 hex	Memory Parity Error	The COM16 slave attempted to read extended memory, but detected a parity error in the memory. The master can retry the request, but service may be required on the COM16 slave device.

Table 4-4

The following functions are not supported by the COM16. If a COM16 slave receives a query for any of these functions, an Exception Code of 01 (Illegal Function) will be the response.

Function 06: Write Single Register

Function 17: Report Slave ID

Function 20: Read General Reference

Function 21: Write General Reference

Function 22: Mask Write 4X Register

Function 23: Read/Write 4X Registers

Function 24: Read FIFO Queue

Default Register List
WL Circuit Break

Default Register Lists (Function 04 Data Blocks)

Basic Data Type 1 Registers and Default Data Points

Register	Byte	Name	Default Data Point – WL
1	0, 1	Status Register	WL status bits
2	2, 3	Data Block 1	Phase 1 current (24070)
3	4, 5	Data Block 2	Phase 2 current (24071)
4	6, 7	Data Block 3	Phase 3 current (24072)
5	8, 9	Data Block 4	Max current in phase under highest load (13150)
6	10	Block 1 property byte	PB of phase 1 current
	11	Block 2 property byte	PB of phase 2 current
7	12	Block 3 property byte	PB of phase 3 current
	13	Block 4 property byte	PB of max current in phase under highest load

Table 4-5

Basic Data Type 2 Registers and Default Data Points

Register	Byte	Name	Default Data Point – WL
1	0, 1	Status Register	WL status bits
2	2, 3	Data Block 1	Phase 1 current (24070)
3	4, 5	Data Block 2	Phase 2 current (24071)
4	6, 7	Data Block 3	Phase 3 current (24072)
5	8, 9	Data Block 4	Max current in phase under highest load (13150)
6	10, 11	Data Block 5	Current in neutral conductor (13152)
7	12, 13	Data Block 6	Average phase to phase voltage (24083)
8	14, 15	Data Block 7	Average of power factors of 3 phases (13149 OR 24114)
9	16, 17	Data Block 8	Total active energy of 3 phases* (24106)
10	18	Block 1 property byte	PB of phase 1 current
	19	Block 2 property byte	PB of phase 2 current
11	20	Block 3 property byte	PB of phase 3 current
	21	Block 4 property byte	PB of max current in phase under highest load
12	22	Block 5 property byte	BP of current in neutral conductor
	23	Block 6 property byte	BP of average phase to phase voltage
13	24	Block 7 property byte	BP of average of power factors of 3 phases
	25	Block 8 property byte	BP of total active energy of 3 phases

*Only 2 bytes of the 4 byte data point will be communicated (range: 0 - 65535MWh)

Table 4-6

Default Register List

WL Circuit Break

Basic Data Type 3 Registers and Default Data Points			
Register	**Byte**	**Name**	**Default Data Point – WL**
1	0, 1	Status Register	WL status bits
2	2, 3	Data Block 1	Phase 1 current (24070)
3	4, 5	Data Block 2	Phase 2 current (24071)
4	6, 7	Data Block 3	Phase 3 current (24072)
5	8, 9	Data Block 4	Max current in phase under highest load (13150)
6	10, 11	Data Block 5	Current in neutral conductor (13152)
7	12, 13	Data Block 6	Phase to phase voltage L1 to L2 (24077)
8	14, 15	Data Block 7	Phase to phase voltage L2 to L3 (24078)
9	16, 17	Data Block 8	Phase to phase voltage L3 to L1 (24879)
10	18, 19	Data Block 9	Phase to neutral voltage L1 (24080)
11	20, 21	Data Block 10	Phase to neutral voltage L2 (24081)
12	22, 23	Data Block 11	Phase to neutral voltage L3 (24082)
13	24, 25	Data Block 12	Average of power factors of 3 phases (13149 OR 24114)
14	26, 27	Data Block 13	Total active energy of 3 phases* (24106)
15	28, 29	Data Block 14	Total apparent power of 3 phases (24085)
16	30	Block 1 property byte	PB of phase 1 current
	31	Block 2 property byte	PB of phase 2 current
17	32	Block 3 property byte	PB of phase 3 current
	33	Block 4 property byte	PB of max current in phase under highest load
18	34	Block 5 property byte	PB of current in neutral conductor
	35	Block 6 property byte	PB of phase to phase voltage L1 to L2
19	36	Block 7 property byte	PB of phase to phase voltage L2 to L3
	37	Block 8 property byte	PB of phase to phase voltage L3 to L1
20	38	Block 9 property byte	PB of phase to neutral voltage L1
	39	Block 10 property byte	PB of phase to neutral voltage L2
21	40	Block 11 property byte	PB of phase to neutral voltage L3
	41	Block 12 property byte	PB of average of power factors of 3 phases
22	42	Block 13 property byte	PB of total active energy of 3 phases*
	43	Block 14 property byte	PB of total apparent power of 3 phases

*Only 2 bytes of the 4 byte data point will be communicated (range: 0 - 65535MWh)

Table 4-7

For additional information on the controlling documents for the definitions of all MODBUS Public Function Codes referenced may be downloaded in PDF format from the MODBUS website http://www.modbus.org.

Default Register List
WL Circuit Break

Complete List of Datasets

Datasets: addresses, number of registers and read/write access of each.

Dataset	Description	Starting register address	Number of registers	Number of data bytes	Padding byte required	Read/ write access
0	NST 2000/S7 diagnostic information	0000h	2	4	—	Rd
1	NST 2000/S7 diagnostic information (includes DS0)	0100h	8	16	—	Rd
51	Main overview	3300h	119	238	—	Rd
60	Control waveform	3C00h	28	55	Yes	Rd/Wr
61	Diagnostic waveform	3D00h	27	54	—	Rd
62	Diagnostic waveform data channel A and B	3E00h	120	240	—	Rd
64	Diagnostic harmonics	4000h	66	131	Yes	Rd
68	Modules information overview	4400h	23	45	Yes	Rd/Wr
69	Control modules	4500h	22	43	Yes	Rd
72	Metering data: min./max. current, form factor, crest factor	4800h	118	236	—	Rd
73	Metering data: min./max. voltage	4900h	87	174	—	Rd
74	Metering data: min./max. power	4A00h	68	136	—	Rd
76	Metering data: min./max. frequency and THD	4C00h	46	92	—	Rd
77	Metering data: min./max. temperature	4D00h	29	58	—	Rd
78	Metering data: min./max. current (VL only)	4E00h	52	104	—	Rd
91	Statistic information	5B00h	42	84	—	Rd
92	Diagnostic breaker	5C00h	97	194	—	Rd
93	Control metering/trip unit	5D00h	14	27	Yes	Wr
94	Metering data	5E00h	99	197	Yes	Rd
97	Identification details	6100h	112	223	Yes	Rd
98	HW/SW versions	6200h	47	93	Yes	Rd
100	Identification NST2000	6400h	50	100	—	Rd
128	Metering parameters	8000h	52	103	Yes	Rd/Wr
129	Protective parameters	8100h	70	139	Yes	Rd/Wr
130	Set point parameters	8200h	74	148	—	Rd/Wr
131	Parameters ON/OFF	8300h	35	70	—	Rd/Wr
160	Bus parameters	A000h	39	77	Yes	Rd/Wr
162	Device configuration	A200h	38	75	Yes	Rd/Wr
165	Identification description	A500h	97	194	—	Rd/Wr

Note:

1. Each Dataset's starting address is the Dataset's number, converted to hex, used as the high byte of the address. Example for Dataset 51:51 decimal equals 33 hex, which gives an address of 3300 hex.
2. Notice that datasets: 60, 64, 68, 69, 93, 94, 97, 98, 128, 129, 160 and 162 have an odd number of data bytes and must be padded with an extra byte at the end of the dataset (set to 00 hex) to create an even number of words (registers).
3. Dataset 98 is for internal use only.

Table 4-8

Default Register List

WL Circuit Break

Sample Dataset

Dataset 94 – Current Metering Values
Starting Address: 5E00 hex, Total Registers: 99, Access: Read Only

Byte	Register	Description Units	Min	Max	(Bits)	Format	Length	Scale
0	64065	Phase unbalance current (in %)	%	0	100	unsigned char	8	0
1	64065	Reserved	—	—	—	—	8	—
2	64066	Demand current 3-phases	A		8000	unsigned int	16	0
4	64067	Demand current L1	A	30	8000	unsigned int	16	0
6	64068	Demand current L2	A	30	8000	unsigned int	16	0
8	64069	Demand current L3	A	30	8000	unsigned int	16	0
10	64070	Phase A current	A	0	65535	unsigned int	16	0
12	64071	Phase B current	A	0	65535	unsigned int	16	0
14	64072	Phase C current	A	0	65535	unsigned int	16	0
16	64073	Current demand over three phases	A	0	65535	unsigned int	16	0
18	64074	Current N-phase	A	0	65535	unsigned int	16	0
20	64075	Ground fault current	A	0	65535	unsigned int	16	0
22	64076	Phase unbalance voltage (in %)	%	0	100	unsigned char	8	0
23	64076	Reserved	—	—	—	—	8	—
24	64077	Delta voltage between Phase L1 and L2	V	15	1150	unsigned int	16	0
26	64078	Delta voltage between Phase L2 and L3	V	15	1150	unsigned int	16	0
28	64079	Delta voltage between Phase L3 and L1	V	15	1150	unsigned int	16	0
30	64080	Star voltage Phase L1	V	10	700	unsigned int	16	0
32	64081	Star voltage Phase L2	V	10	700	unsigned int	16	0
34	64082	Star voltage Phase L3	V	10	700	unsigned int	16	0
36	64083	Demand of the delta voltage	V	5	1150	unsigned int	16	0
38	64084	Demand of the star voltage	V	10	700	unsigned int	16	0
40	64085	Sum of apparent power	kVA	39	24000	unsigned int	16	0
42	64086	Sum of real power	kW	-24000	24000	signed int	16	0
44	64087	Real power in Phase L1	kW	-8000	8000	signed int	16	0
46	64088	Real power in Phase L2	kW	-8000	8000	signed int	16	0
48	64089	Real power in Phase L3	kW	-8000	8000	signed int	16	0
50	64090	Sum of reactive power	kvar	-24000	24000	signed int	16	0
52	64091	Demand of the real power 3-phases	kW	-8000	8000	signed int	16	0
54	64092	Demand of the real power in Phase L1	kW	-8000	8000	signed int	16	0
56	64093	Demand of the real power in Phase L2	kW	-8000	8000	signed int	16	0
58	64094	Demand of the real power in Phase L3	kW	-8000	8000	signed int	16	0
60	64095	Demand of the apparent power 3-phases	kVA	13	8000	unsigned int	16	0
62	64096	Apparent power in Phase L1	kVA	13	8000	unsigned int	16	0
64	64097	Apparent power in Phase L2	kVA	13	8000	unsigned int	16	0
66	64098	Apparent power in Phase L3	kVA	13	8000	unsigned int	16	0
68	64099	Demand of the apparent power i. d. Phase L1	kVA	13	8000	unsigned int	16	0

(continued on the next page)

Default Register List
WL Circuit Break

Dataset 94 – Current Metering Values
Starting Address: 5E00 hex, Total Registers: 99, Access: Read Only (continued from the previous page)

Byte	Register	Description	Units	Min	Max	Format	Length (Bits)	Scale
70	64100	Demand of the apparent power i. d. Phase L2	kVA	13	8000	unsigned int	16	0
72	64101	Demand of the apparent power i. d. Phase L3	kVA	13	8000	unsigned int	16	0
74	64102	Demand of the reactive power 3-phases	kvar	-8000	8000	signed int	16	0
76	64103	Reactive power in Phase L1	kvar	-8000	8000	signed int	16	0
78	64104	Reactive power in Phase L2	kvar	-8000	8000	signed int	16	0
80	64105	Reactive power in Phase L3	kvar	-8000	8000	signed int	16	0
82	64106	Real energy in normal direction	MWh	0	10000	unsigned long	32	0
86	64108	Real energy in reverse direction	MWh	0	10000	unsigned long	32	0
90	64110	Reactive energy in normal direction	Mvarh	0	10000	unsigned long	32	0
94	64112	Reactive energy in reverse direction	Mvarh	0	10000	unsigned long	32	0
98	64114	Demand of the power factor	PF	600	1000	signed int	16	0.001
100	64115	Power factor in Phase L1	PF	600	1000	signed int	16	0.001
102	64116	Power factor in Phase L2	PF	600	1000	signed int	16	0.001
104	64117	Power factor in Phase L3	PF	600	1000	signed int	16	0.001
106	64118	Frequency	Hz	1500	44000	unsigned int	16	0.01
108	64119	THD of the current	%	1	100	unsigned char	8	0
109	64119	THD of the voltages	%	1	100	unsigned char	8	0
110	64120	Form factor	0	0	255	unsigned char	8	0.1
111	64120	Crest factor	0	0	255	unsigned char	8	0.1
112	64121	Reserved	-	-	-	-	16	-
114	64122	Temperature in the cubicle (detected in the COM16)	°C	-127	128	unsigned char	8	0
115	64122	Temperature in the circuit breaker (detected in BSS)	°C	-20	85	unsigned char	8	0

Table 4-9

Bit Mapping for Breaker Status Register 413158

Byte	Register	Description
0	Bit 0	Breaker Open
0	Bit 1	Breaker Closed
0	Bit 2	Breaker Tripped (mechanical trip indication)
0	Bit 3	Breaker is ready to close
0	Bit 4	Storage spring is charged
0	Bit 5	1st auxillary release is operated
0	Bit 6	2nd auxillary release is operated

Table 4-10