

### 3. Generic Definition

This section will define the protocol in generic terms.

#### 3.1 Data Packets

Data is transferred between devices within variable length data packets. The format of a data packet is shown in Figure 1..

HEADER_1	HEADER_2	CLASS	DATA_LEN	DATA	CHECKSUM
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**Figure 1. Data Packet Format**

The fields in a data packet are described in Table 4. below.

Field	Length (bytes)	Value	Description
HEADER_1	1	0xAA	Packet Header byte # 1
HEADER_2	1	0x55	Packet Header byte # 2
CLASS	1	0x00 to 0xFF	The packet classifier. This indicates the type of data carried within the packet. This is also referred to as the payload classifier.
DATA_LEN	1	1 to 250	The length of the data in the Data field of the packet.
DATA	1 to 250	0x00 to 0xFF for every byte.	The actual data (payload) carried in the packet.
CHECKSUM	1	0x00 to 0xFF	An 8-bit, 1's complement checksum, calculated over the CLASS, DATA_LEN and DATA fields.

**Table 4. Data Packet Field Description**

##### 3.1.1 Example

An example of a data packet is as follows:

0xAA	0x55	0x27	0x02	0xC3, 0x12	0x01
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The checksum in this example is calculated as follows:

$$\begin{aligned}
 \text{CHECKSUM} &= \sim(0x27 + 0x02 + 0xC3 + 0x12) \\
 &= \sim(0xFE) \\
 &= 0x01
 \end{aligned}$$

## 4.1 Motorscope: Controller Operational Data

Byte #	Identifier	Value/Contents/Comments
0	Header 1	See section 3.1
1	Header 2	See section 3.1
2	Class	0x00
3	Data length	29
4	Data byte 0	Controller Model <sup>1</sup>
5	Data byte 1	Minimum phase angle config (degrees)
6	Data byte 2	CT ratio config
7	Data byte 3	Motor startup time config (seconds)
8	Data byte 4	Overload allow time config (seconds)
9	Data byte 5	Underload allow time config (seconds)
10	Data byte 6	Maximum current config (A/D current in ampere)
11	Data byte 7	Underload auto restart timer config (4 minute intervals) <sup>2</sup>
12	Data byte 8	Assisted Calibration Maximum current (A/D current in ampere)
13	Data byte 9	General Info Bit-Field (See Note 2 below section 4.19)
14	Data byte 10	Auxiliary contact type (N/O or N/C)
15	Data byte 11	Underload auto restart / Temperature timer state config (enabled/disabled) <sup>3</sup>
16	Data byte 12	Minimum power config low byte
17	Data byte 13	Minimum power config high byte
18	Data byte 14	Maximum power config low byte
19	Data byte 15	Maximum power config high byte
20	Data byte 16	Temperature timer config (minutes)
21	Data byte 17	V1 measurement
22	Data byte 18	V2 measurement
23	Data byte 19	V3 measurement
24	Data byte 20	Phase angle measurement
25	Data byte 21	Current measurement
26	Data byte 22	Underload auto restart timer measurement <sup>4</sup>
27	Data byte 23	Instantaneous power measurement (low byte)
28	Data byte 24	Instantaneous power measurement (high byte)
29	Data byte 25	Lowest recorded power (low byte)
30	Data byte 26	Lowest recorded power (high byte)
31	Data byte 27	Highest recorded power (low byte)
32	Data byte 28	Highest recorded power (high byte)
33	Checksum	See section 3.1

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Model Name	Model ID	Comments
B110M	0	Underload auto-restart timer implemented by means of analog potentiometer on the Controller. Calibrate button on Controller.
B110M10	1	Underload auto-restart timer set via Optimiser and stored in calibration configuration on the Controller. No calibrate button on Controller.
COOLSCOPE	2	Underload auto-restart timer implemented by means of analog potentiometer on the Controller. Calibrate button on Controller. No Overload Auto-Restart. Works differently to normal Motorscope.
C115	3	Underload auto-restart timer set via Optimiser and stored in calibration configuration on the Controller. No calibrate button on Controller. Checks the system voltage at each power-up. Either 525Vpp or 1000Vpp.

2. Contains meaningful data for B110M10 model only.

3. Format ( $\Phi$  = don't care):

Timer ID	Enabled	Disabled
Underload auto restart timer	0x5 $\Phi$	0xC $\Phi$
Temperature timer	0x $\Phi$ A	0x $\Phi$ 3

4. Contains meaningful data for B110M model only.

## 4.2 Motorscope: Controller Error Data

Byte #	Identifier	Value/Contents/Comments
0	Header 1	See section 3.1
1	Header 2	See section 3.1
2	Class	0x01
3	Data length	2
4	Data byte 0	Current error indication (See notes below)
5	Data byte 1	Additional error information (See notes below)
6	Checksum	See section 3.1

**Notes:**

The current error indication may have one of the following values:

Current Error Indication Value	Error type
0	Phase sequence
1	V1
2	V2
3	V3
4	Maximum power (overload)
5	Maximum current
6	Minimum phase angle (overload)
7	Minimum power (underload)
8	Phase imbalance
9	Auxiliary inhibit
10	No Current
11	Controller
12	Temperature Timer
13	Voltage Frequency
14	Earth Leakage
15	Back-EMF
16 to 255	Unknown

The additional error information is as follows

Error Type	Additional Information
Temperature Timer	Minutes remaining before timer timeout.
Controller	Controller error identifier (error specifics)
Minimum power (underload)	0x00: No additional info 0x01: Phi > 60° during calibration 0x02 to 0xFF: Reserved (no additional info)
Insulation Test	The cycle in which the insulation error occurred: 0x00: Pre-run Test 0x01: Self-Test Active 0x02: Self-Test Inactive 0x03: Continuous 0x04: Idle

## 4.20 Motorscope: Device Status

Byte #	Identifier	Value/Contents/Comments
0	Header 1	See section 3.1
1	Header 2	See section 3.1
2	Class	0x13
3	Data length	1
4	Data byte 0	Status identifier: 0x00 = Reserved. 0x01 = Uncalibrated 0x02 = Calibrating 0x03 = Delayed Calibration 0x04 = Reset Input Active All other values reserved
5	Checksum	See section 3.1

**NOTE:**

When this packet class is transmitted directly after a Controller Operational Data packet (CLASS 0x00) then it is an indication that the motor is running while this status is in progress. Thus, if this packet is transmitted on its own, it is an indication that the motor is stopped.