WATCHDOG 'ELITE' NTC

SERIAL COMMUNICATIONS OPTION

The Watchdog is a complex piece of equipment and performs many functions. The communications function is considered a 'low priority' function and because of this the Watchdog will not respond to a high poll rate. We therefore recommend that you poll the Watchdog(s) about once every 2 seconds. Polling more frequently will not cause problems but the Watchdog will not reply to most of the poll requests. It is possible to poll up to 32 Watchdogs in sequence. It is permitted to poll all 32 Watchdog in quick succession but this must not be repeated more frequently than every 2 seconds otherwise you may experience data loss. We recommend that you implement a 'retry' policy if a Watchdog fails to respond to a poll for data.

The WATCHDOG 'ELITE' is equipped with an RS485 communications interface. Below is a description of the physical requirements and the communications protocol.

Physical Requirements.

Communication is achieved through a 4 (four)-wire communications system. The format used meets the requirements of the RS485 communication standard. The WATCHDOG ' *Elite'* units can be connected together in a free topology network (any order). A twin twisted cable with either individual pair or overall screen should be used. The network should not have a cable length of greater than 1000 meters. The cable should have each pair terminated at each end with a 120-ohm ½ watt resistor. Longer distances can be achieved by the use of a signal repeater. The Network can consist of a maximum of 32 devices. This includes WATCHDOG, *Elite'* units and/or other devices including PLC or computer based controllers which can use the same protocol. All devices must be capable of working in a multi master mode (high impedance transmitters when not in use).
It is possible to connect a single WATCHDOG ' *Elite'* to a single PLC or computer using the RS422 standard as an alternative. In essence, the two standards are the same except that RS422 cannot be used with multiple master devices.

Protocol Requirements.

The Watchdog' *Elite'* expects to be polled by a host device. When it receives a correctly formatted poll message containing its own ID in the header, it responds by transmitting a packet of characters back to the host.

The communications format is fixed at 9600 Baud, 8 data bits and 1 stop bit and is used in the following manner.

Request Poll.

The poll message format is a packet of five characters. <STX> <ID1> <ID2> <ETX><NULL>
Control characters are used to initiate and end the sequence.

STX = 02 (HEX) ' Start of transmission. , ETX = 03 (HEX) 'End of transmission.' The NULL (00) is used for timing reasons and caries no value.

The comms ID has a range of 1-80Hex, (1-128Dec), and is formatted as two **ASCII** characters, e.g.

WATCHDOG ID address 18H is made up of ID 1 = 31 Hand ID2 = 38H. (**31H is ASCII for 1 and 38H is ASCII for 8).**

Response.

The response to a request is in the following format.
<STX> <ID1> <ID2> <DATA (x48)<CK1> <CK2> <ETX>

Comms ID field

The comms ID is two bytes formatted as in the 'Request Poll' described above.

Data Field.

The data field in the response packet is 48 characters encoded as follows.
Watchdog speed monitoring section

Dl, D2	Speed high byte
D3, D4	Speed low byte.
D5, D6	Status code byte.
D7, D8	Status data byte.
D9, D10	Under speed alarm setting percentage.
D 11, D12	Under speed stop setting percentage.
D13, D14	Over speed alarm setting percentage.
D15, D16	Over speed stop setting percentage.
D 17, D 18	Calibrated speed high byte.
D19, D20	Calibrated speed low byte.
D21, D22	Scale factor high byte.
D23, D24	Scale factor low byte.
D25, D26	Flags byte- Reserved.

Watchdog NTC section

D27, D28	Temperature for sensor 1 & 2
D29, D30	Temperature for sensor 3 & 3
D31, D32	Temperature for sensor 5 & 6
D33, D34	Status for sensor 1 & 2
D35, D36	Status for sensor 3 & 4
D37, D38	Status for sensor 5 & 6
D39, D40	Alarm level for sensor 1 & 2
D41, D42	Alarm level for sensor 3 & 4
D43, D44	Alarm level for sensor 5 & 6
D45, D46	D45 = NOS: D46 Flags
D47, D48	D47 = Persistent alarm time (NTC) : D48 Reserved

ID1, ID2, D1 to D26, CK1 and CK2 data is encoded as an **ASCII character representation of a HEX number**, i.e. two characters are required to represent one HEX byte.

D27 to D48 are represented directly in Hexadecimal.

Examples
i) Speed
Speed is a special case as decimal point data is encoded within the high byte, D 1.
There can be either 1 or 2 decimals.
For one decimal, add 4000H
For two decimals, add 8000H

E.g. If speed= 99.99 Pulses per minute (PPM), there are 2 decimal places and this is encoded as

270F H + 8000 H = A70F H
Therefore
D1 = 41H   'A'
D2 = 37H   '7'
D3 = 30H   '0'
D4 = 46H   'F'

ii) Status code
If status code = 36 D, (24H) then this is encoded as
D5 = 32H, D6= 34H

Checksum field.

The checksum is a byte-sized sum of all characters in the ID and data fields only. This is encoded within the message as two ASCII characters in CK1 and CK2.

List of main Watchdog Status codes.

The status code is encoded in D5 and D6 as an ASCII representation of a HEX byte.

Examples.
'Elevator running'   is 36 Decimal, = 24HEX, so D5 = 32HEX and D6 = 34HEX.
'HBS open cct zone5' is 90 Decimal, or 5A HEX, therefore D5= 35HEX and D6= 41HEX.

Code	Description		D5 :	D4 (ASCII)
02	Test Mode:	Showing Calibrated speed.	30	32
03	Test Mode:	Showing under speed Alarm.	30	33
04	Test Mode:	Showing under speed Stop.	30	34
05	Test Mode:	Showing over speed Alarm.	30	35
06	Test Mode:	Showing over speed Stop.	30	36
07	Test Mode:	Showing End of Test.	30	37
09	Watchdog is calibrating.		30	39
15	Elevator stopped Persistent belt slip conditions.		30	45
16	Elevator stopped (Persistently over speeding).		31	30
17	Misalignment detected at top & bottom sensors.		31	31
34	Elevator is stopped and ready to run.		32	32
35	Elevator is accelerating.		32	33
36	Elevator running.		32	34
37	Stop Relay has been de-energised.		32	35
39	Misalignment detected- Alarm relay about to de-energised.		32	37
42	Over speeding Alarm relay about to de-energise.		32	40
45	Misalignment detected at top of Elevator.		32	43
47	Over-calibration... Stop relay about to de-energise.		32	45
49	Speed display is over range check Scale Factor.		33	31
50	Start Elevator to commence calibration procedure.		33	32
57	Belt slipping -Alarm relay about to de-energise.		33	39
58	Belt slipping Stop relay about to de-energise.		33	40
59	Elevator stopped due to lack of acceleration.		33	41
60	Persistent Alarm delay count is showing on LCD.		33	42
61	Elevator stopped speed exceeded over speed Stop limit.		33	43
62	Interlock signal off waiting for zero speed.		33	44
63	Elevator stopped persistent alarm conditions.		33	45
64	Elevator stopped because of severe under speed or belt slip.		34	30

65	Watchdog has no calibrated speed. Please see manual.	34	31
66	Misalignment detected at bottom of elevator.	34	32
68	Wrong access code entered.	34	34
70	Elevator speed less than alarm level (belt slipping?).	34	35
71	Elevator speed exceeds alarm level (Over speeding).	34	36
74	Suspect fault with one or more MAS e.g. mains pickup.	34	40
76	Testing Alarm relay de-energised.	34	42
77	Testing both relays de-energised.	34	43
78	Plug switch is open.	34	44
79	Head Pulley Alignment Switch is open.	34	45
80	Hot bearing at Zone 1. (PTC Only)	35	30
81	Hot bearing at Zone 2. (PTC Only)	35	31
82	Hot bearing at Zone 3. (PTC Only)	35	32
83	Hot bearing at Zone 4. (PTC Only)	35	33
84	Hot bearing at Zone 5. (PTC Only)	35	34
85	Hot bearing at Zone 6. (PTC Only)	35	35
86	HBS is open circuit at Zone 1. (PTC Only)	35	36
87	HBS is open circuit at Zone 2. (PTC Only)	35	37
88	HBS is open circuit at Zone 3. (PTC Only)	35	38
89	HBS is open circuit at Zone 4. (PTC Only)	35	39
90	HBS is open circuit at Zone 5. (PTC Only)	35	40
91	HBS is open circuit at Zone 6. (PTC Only)	35	41

Some Status Codes have associated data, which is encoded in D7 and D8. For status codes not on the following list, the Status data is invalid, so should be disregarded. Below is a list of Status Codes, which have associated data:

Status code	Associated Status Data (from above list)	D7 :	D8 (ASCII)
03	Under speed Alarm percentage.	30	33
04	Under speed stop percentage.	30	34
05	Over speed Alarm percentage.	30	35
06	Over speed stop percentage.	30	36
09	% of Calibration completed.	30	39
35	Start-up Delay seconds remaining.	32	33
36	Percentage speed (of calibrated).	32	34
39	Seconds remaining before Alarm relay de-energisation.	32	37
42	Seconds remaining before Alarm relay de-energisation.	32	40
47	Seconds remaining before Stop relay de-energisation.	32	45
57	Seconds remaining before Alarm relay de-energisation.	33	39
58	Seconds remaining before Stop relay de-energisation.	33	40
60	Persistent Alarm Counter value (seconds) decreasing.	33	42
62	Percentage speed (of calibrated).	33	44
70	Percentage speed (of calibrated).	34	36
71	Percentage speed (of calibrated).	34	37
80-85	Temperature in Celsius (NTC thermistors only).		

NTC Temperature sensor data

The Watchdog can work with either 1-6 PTC temperature sensors **or** 1-6 NTC temperature sensors. It is not possible to use both. PTC sensors use a fixed trip point (set by the sensor in use) so no variable data is available at the communication port only fixed status data such as HOT bearing. NTC sensors however can produce a variable temperature either in °C or °F according to the settings of the Watchdog. The communications data has been modified to include this information in the data stream.

D27 to D32
The NTC sensor measure temperatures from -31°C to +110°C (-23°F to +230°F). The Watchdog cannot represent a negative sign so all numbers are positive. To represent a negative number it is necessary to perform a simple sum.

For Example, if the temperature is set to display in °C do the following:
If the reported temperature is between 0 and 110 take this as the actual temperature (+0°C to +110°C).

If the reported temperature is greater than **110** then do the following calculation.
$\quad$ (255 – temperature) = (negative)temperature
$\quad$ EG. If the temperature is 248 then (255 - 248) = 7 treat this as negative so we have (-7°C)

For Example, if the temperature is set to display in °F do the following:
If the reported temperature is between 0 and 230 take this as the actual temperature (+0°F to +230°F).

If the reported temperature is greater than **230** then do the following calculation.
$\quad$ (255 – temperature) = (negative)temperature
$\quad$ EG. If the temperature is 248 then (255 - 248) = 7 treat this as negative so we have (-7°F)

D27 = Temperature for sensor 1
D28 = Temperature for sensor 2
D29 = Temperature for sensor 3
D30 = Temperature for sensor 4
D31 = Temperature for sensor 5
D32 = Temperature for sensor 6

D33 to D38
The NTC sensors are monitored for several fault conditions:
Condition 0 = Normal signal conditions exists
Condition 1 = Temperature is over range so an alarm has been generated
Condition 2 = Sensor seems to be open circuit
Condition 3 = Sensor seems to be short circuit
The status condition for each sensor is represented as a number from 0 to 3

D33 = Status condition sensor 1
D34 = Status condition sensor 2
D35 = Status condition sensor 3
D36 = Status condition sensor 4
D37 = Status condition sensor 5
D38 = Status condition sensor 6

D39 to D44
The NTC sensors have an individual alarm level associated with each sensor the value can be between 0°C and 110°C (0°F and 230°F)
D39 = Trip alarm level for sensor 1
D40 = Trip alarm level for sensor 2
D41 = Trip alarm level for sensor 3
D42 = Trip alarm level for sensor 4
D43 = Trip alarm level for sensor 5
D44 = Trip alarm level for sensor 6

D45 & D46

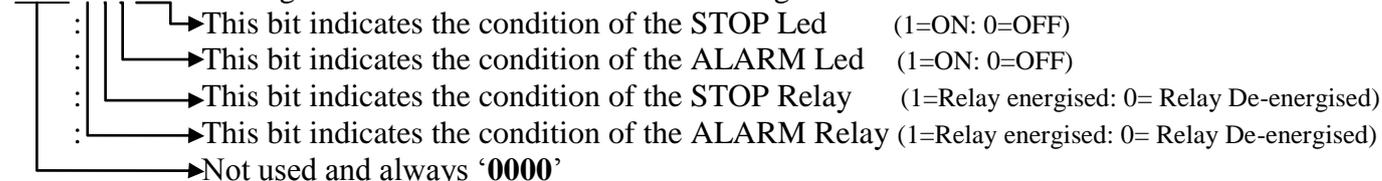D45 = Number of programmed sensors

This value will be between 0 and 6 indicating how many NTC sensors are programmed and active at the present time.

D46 = Watchdog condition flags.

This byte contains information relating to the status of the Watchdog LED's and Relays. Although the byte is represented in Hexadecimal converting it to binary helps to explain the contents a little better.

0000:0000   The left hand four bits are always **0000** and can be ignored.
0000:0000   The right hand four bits contain the following information.

   :   →This bit indicates the condition of the STOP Led   (1=ON: 0=OFF)
   :   →This bit indicates the condition of the ALARM Led   (1=ON: 0=OFF)
   : →This bit indicates the condition of the STOP Relay   (1=Relay energised: 0= Relay De-energised)
   : →This bit indicates the condition of the ALARM Relay (1=Relay energised: 0= Relay De-energised)
   →Not used and always '**0000**'

If D46 = 00 then no conditions exist
If D46 = 02 then the alarm Led is on (0000:0010)
If D46 = 0A then the alarm Led and Alarm Relay are active (000:1010)
If D46 = 03 then both Led's are on and both Relays are de-energised (0000:0011)

D47 & D48

D47 = Time to stop

When a high temperature or fault condition is detected on one or more temperature sensors the Watchdog will allow the fault to persist for a maximum of 180 seconds. D47 shows the current value of the timer in seconds counting from 180 down to 0. When the timer reaches '0' the Watchdog stop relay is de-energised (refer to the Watchdog manual for a detailed explanation of this function).

D48 = FF: This value is a test value and can be ignored

Reminder:
The information contained in D27 to D48 is encoded as single HEXADECIMAL bytes.

Example: (using °C in the example)
If D27 = 1C(Hex) this converts to +28°C decimal
If D27 = E3(Hex) this converts to 227 decimal
As this is > 110 we do the sum 255-227 and call the result negative. So 255 – 227 = 28 (-28°C)

Example: (using °F in the example)
If D27 = 0F(Hex) this converts to +15°F decimal
If D27 = F0(Hex) this converts to 240 decimal
As this is > 230 we do the sum 255-240 and call the result negative. So 255 – 240 = 15 (-15°F)

Example:
If D33 = 0 then temperature sensor 1 is normal
If D33 = 1 then temperature sensor 1 is over the alarm trip level
If D33 = 2 then temperature sensor 1 is open circuit
If D33 = 3 then temperature sensor 1 is short circuit

Example:
If D39 = 50(Hex) this converts to 80 so the alarm level for sensor 1 is 80°C

Example:
If D47 = B4(Hex) this converts to 180 so there is 180 seconds to go before the STOP relay is activated

Example:
If D45 = 4 this indicates that only the first 4 sensors (1 to 4) are programmed for use and 5 & 6 are free for use.