Operating Manual for
RS422 interfaced
Eltex Tension Monitor

General Description

The Eltex Tension Monitor is an on-line device for sewing machines and similar applications. The ETM monitors the thread tension and also acts as a thread break detector. It enables the operator to keep the yarn tension within the desired tension range for best operation and quality.

Advantages

- Improves sewing quality
- Allows you to operate with the correct thread tension.
- Acts as a thread break detector.
- Alerts the operator to dust and dirt in the thread tensioners.
- Makes it easier for the operator to set the correct bobbin tension.

Features

- Monitors thread tension according to limits set by software through RS422 interface.
- Programmable measuring ranges.
- Programmable RS422 message with peak tension and monitor status for every revolution.
- Programmable stop filter function.
- Generates message alert pulse to alert control computer of limit exceedings.
- Separate sensor and electronics enables fitting in tight areas.
- Flexible software programmable operation parameters.
- Led indications of monitored limits.
- Led indication of synchronisation input.
- Optocoupler separated synchronisation input.
- Optocoupler separated message alert output.
- Factory calibrated - no manual reset required.

Fitting

1. Fit the sensor head after the existing thread brake. It should be fitted as close to the needle as possible, deflecting the thread as little as possible from the original path.
2. If possible fit the electronics box so that it is possible to watch the LED's and adjust the thread brake at the same time.
3. A proximity switch should be fitted facing the main shaft of the machine. A metal piece should be fitted to the main shaft to make the proximity switch give one pulse every revolution. The ETM (Eltex Tension Monitor) needs one pulse at a certain moment every revolution. It should get a positive edge at the synchronising input when the pull back arm has travelled 2/3 towards the lowest position. The thread tension is then as close to zero as possible. This is very important to get the ETM to work properly. The length of the sync pulse is of little importance. The only relevant thing is that the positive edge arrives at the right moment on the ETM sync. input.

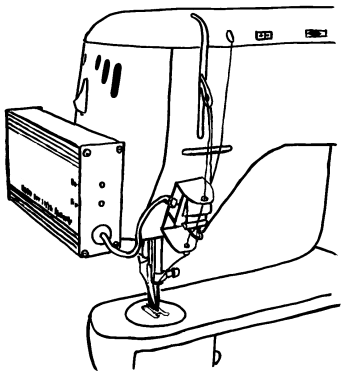
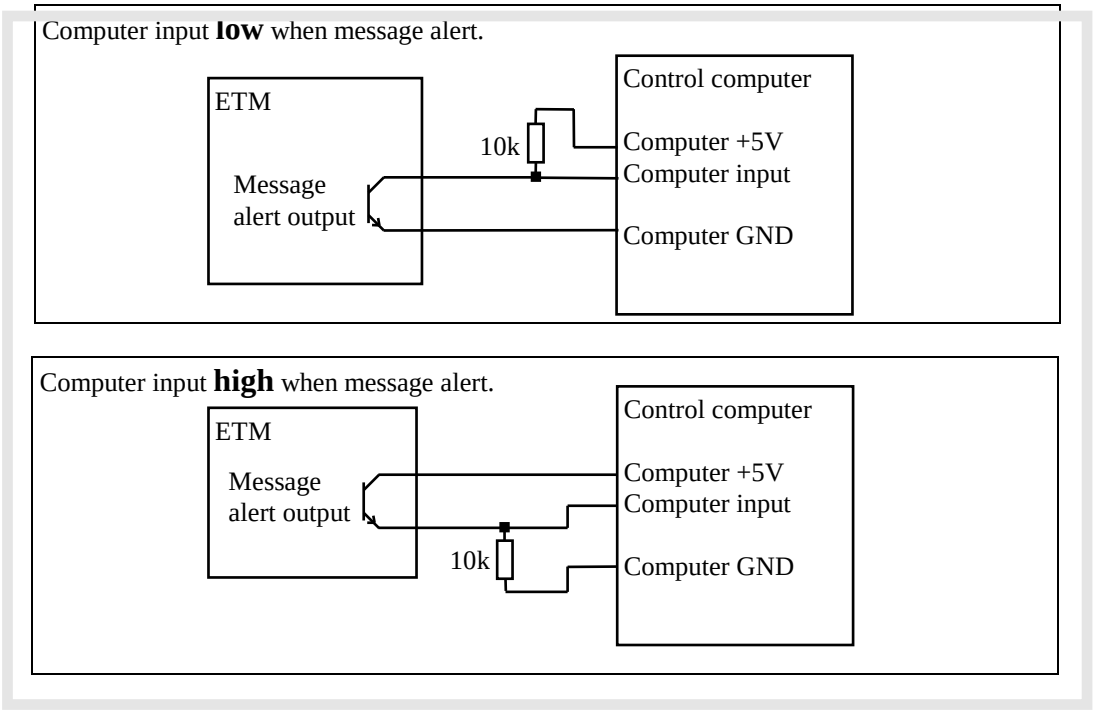


Figure 2. ETM fitted to a sewing machine

N.B. The sensor head **must not** be disassembled and the cable between the units **must not** be cut or exchanged. If this is done, the sensor head must be re-calibrated and adjusted.

Wiring

1. Connect the power supply to pin 15 and ground to pin 8 in the ETM D-sub connector. Note that the metal housing of the electronics box is connected to the electronics ground. The electronics box housing and the sensor metal housing **must** be electrically connected. The connection is normally accomplished by the fastening screws.
2. Connect the proximity switch supply cables to supply and ground.
   If you use a PNP, normally open proximity switch, the proximity switch output should be connected to the positive synchronising input (ETM D-sub pin 12) and the negative synchronising input to ground.
3. The proximity switch should have a switching frequency several times the frequency used, to ensure that there is no delay on the sync. input. We recommend a switching frequency of 1000 Hz or higher. The LED at the side of the ETM D-sub connector indicates the state on the sync input. This makes it possible to check a proximity switch without LED indicator.
4. Connect the message alert output using a pull up resistor or a pull down resistor (see picture 3).The message alert pulse will be active in approx. 2 seconds at stop limit exceed condition and will then go back to passive state. The message alert signal is normally used to alert the control computer that a stop limit has been exceeded.
5. Connect the RS422 lines. The ETM RS422 data inputs are pin 10 (input A) and pin 2 (input B) which must be connected to the control computer TXD lines. The ETM RS422 data outputs are pin 1 (output A) and pin 9 (output B) which must be connected to the control computer RXD lines. Connect the ground from the control computer to the ETM ground pin 3.



Typical Application

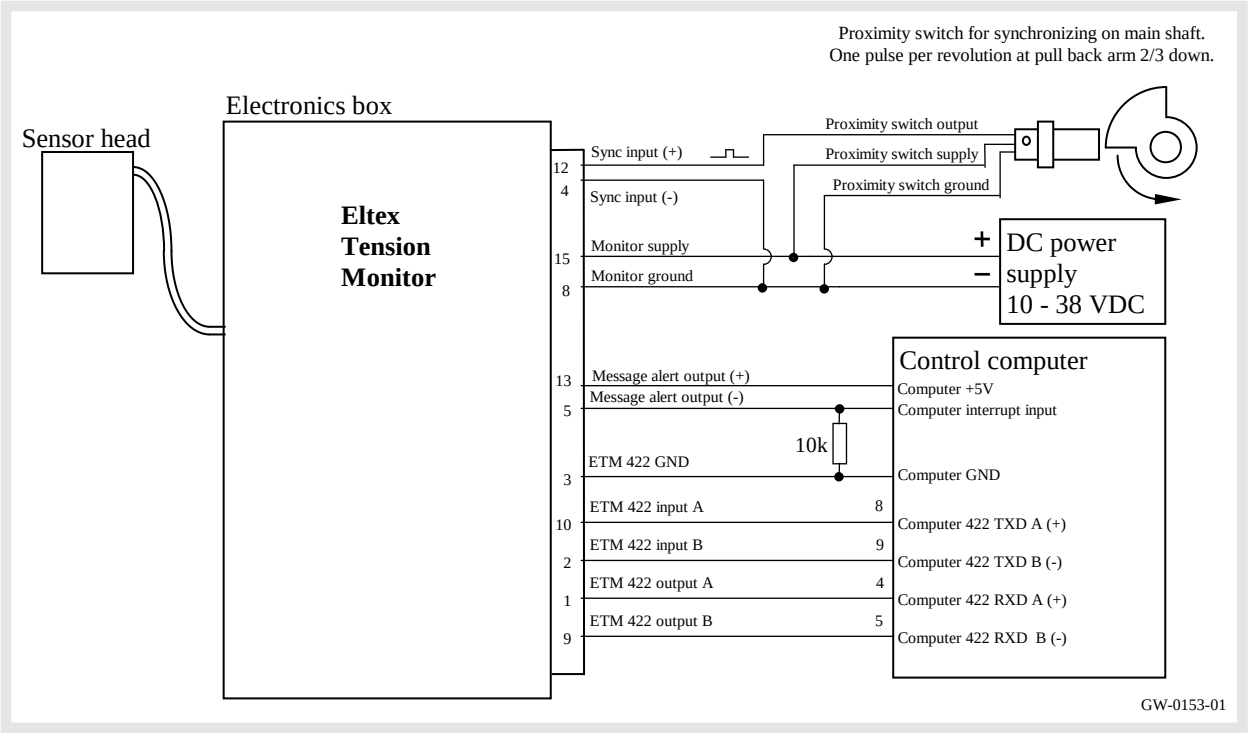


Figure 4. Connection diagram

Limit exceed detection

3 examples of different methods to transfer information of a limit exceed event from ETM to the control computer.

No runtime event:
Set the ETM not to send the runtime event at any time (Command byte: bit 7=0, bit 6=0).
Set the stop limits and the indication limits to relevant values. When one of the stop limits is exceeded and the stop filter condition is satisfied, the ETM always sends a message alert pulse and stops monitoring. Detect the pulse with a input on the control computer. Stop the machine. Transmit a 16 byte block, read the limit exceed information in the answer from the ETM.

Runtime event message at limit exceed:
Set the ETM to send the runtime event at every limit exceed (Command byte: bit 7=1, bit 6=1).
Set the indication limits to 0 (0 = disabled), set the stop limits to relevant values. When one of the stop limits is exceeded and the stop filter condition is satisfied, the ETM will send a runtime event message and stop monitoring. This message contains information about which stop limit that has been exceeded and the tension of the stitch when the limit exceed occurred.
In this case you do not need to connect the message alert output.

Runtime event message at every stitch:
Set the ETM to send the runtime event at every stitch (Command byte: bit 7=1, bit 6=0).
Set the indication limits and the stop limits to relevant values. The ETM will now, at every stitch, transmit a runtime event message containing limit exceed information bits and the tension of the stitch. When a stop limit is exceeded (stop filter condition included) the ETM will set the corresponding bits in the runtime event message and stop monitoring. The control computer will have to evaluate the limit exceed bits for every stitch.
In this case you do not need to connect the message alert output.

Setting procedure

All settings are made from the control computer through the RS422 interface (see ETM communication area). The following instructions are just an example of one method to get the ETM to work properly. Once the structure of the ETM system is fully understood there is a lot of different ways to approach this procedure.

1. Guess the tension and set the measuring range to a range were the maximum tension is approximately 150% of the guessed tension. Once step 2 to 4 is completed you will discover if the selected measuring range is the proper one. If you select a range that is much to low, the ETM will indicate over-range-error by flashing the high led very fast and activating the message alert line even if the stop limits are disabled.
2. Set the stop limits to zero. This will disable the stop limits and they will not interfere with the beginning of the setting procedure.
3. Set the ETM to transmit the peak thread tension every revolution.
4. Run the machine while receiving the 3 byte messages for every stitch. Watch the received tension values and set the indication and stop limits according to that value.
5. Set the stop filter to the desired value. This value controls how many stitches in a row that must exceed one stop limit before a message alert is transmitted.

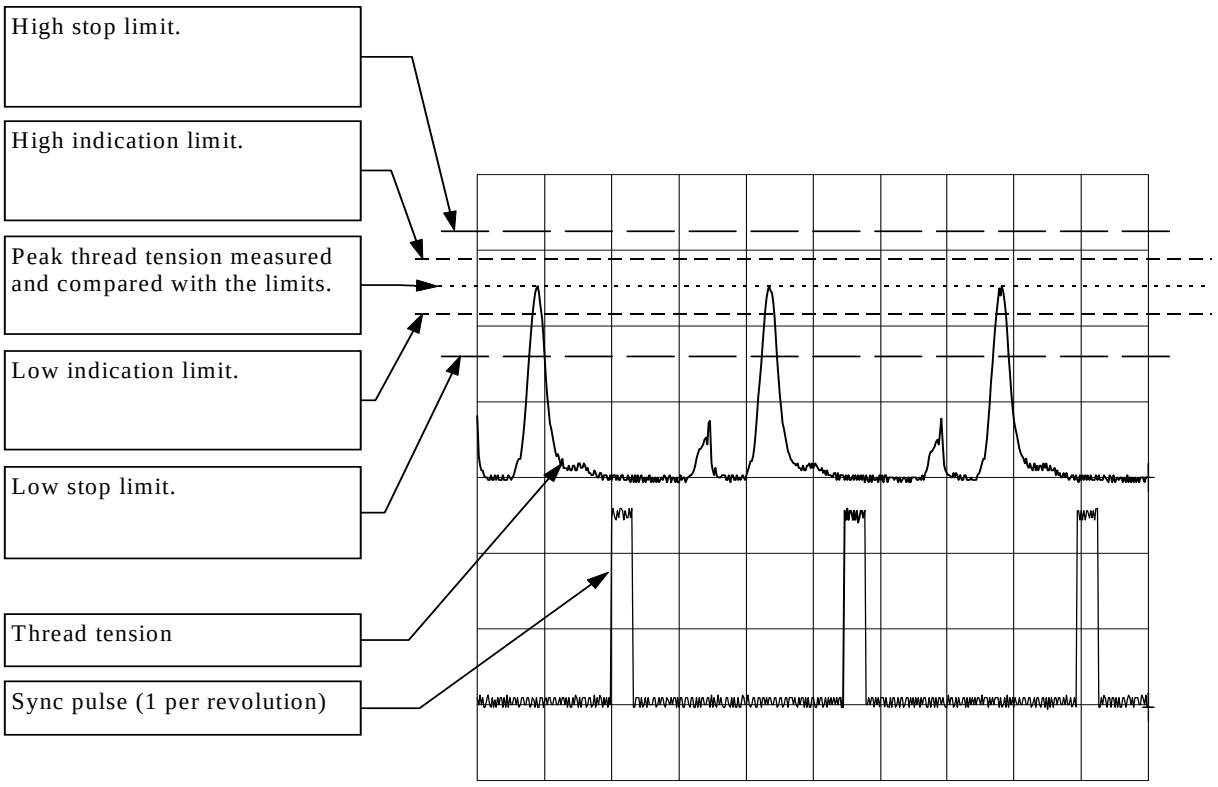


Figure 5. Oscilloscope measurement made with ETM.

Characteristics

Measuring ranges adjusted within: 0–1200 cN
Available measuring ranges: 0–128 cN, 0–256 cN, 0–384 cN, 0–512 cN, 0–640 cN, 0–768 cN, 0–896 cN, 0–1024 cN, 0–1152 cN, 0–1280 cN, (0–1408 cN, 0–1536 cN).

Stop filter: 1–15 stitches.

RS422 Parameters: 9600 baud, 1 start bit, 8 data bits, 1 stop bit, 1 parity bit, even parity

Supply voltage..... 10–38 V dc
Maximum current consumption..... 50 mA
Maximum start peak current (note1) ..... 500 mA
Speed range..... 120–10 000 RPM
Message alert pulse length ..... Minimum 2 seconds
Cable length between sensor head end electronics box..... 100mm (50–500 mm on request)
Electronics box dimensions (width x height x depth)..... 100 x 61 x 25 mm
Sensor head dimensions (width x height x depth) ..... 25 x 42 x 29 mm
Message alert output ..... Optocoupler TLP127, max 100 mA
Synchronisation input..... Optocoupler TLP112, Rin: 1,5 kΩ, Vin: 5–35 V dc
Working ambient temperature range ..... +15ºC to +45ºC (60–110ºF)
Working ambient humidity range..... 0–95% RH (at 45°C) no condensation
Accuracy ..... ±10% of selected measuring range

note1: At supply voltage 38 V DC and power supply start-up time = 30 ms.

If the ETM unit is used in an application where periodic calibration is required, Eltex recommend to do this yearly at Eltex of Sweden main office.
Other calibration interval can be decided by the user.

N.B. The sensor head must not be disassembled and the cable between the units must not be cut or exchanged. If this is done, the sensor head must be re-calibrated and adjusted.

Pin configuration in 15 p. D-sub connector

Function	Pin
Ground	8
Supply (12-38V DC)	15
Message alert(+)	13
Message alert(-)	5
RS 422 receiver input A	10
RS 422 receiver input B	2
RS 422 transmitter output A	1
RS 422 transmitter output B	9
RS 422 Ground	3
Synchronisation input (+)	12
Synchronisation input (-)	4
*1	6
*1	7
*1	11
*1	14

*1= Leave unconnected, reserved for future options.

Declaration of conformity according to the EMC Directive 89/336/EEC

The Eltex Tension Monitor ETM422 conforms to the standard EN 61326-1 (1997)

We reserve the right to modify the design and technical data.

Communication protocol
for ETM with RS422 interface.

The ETM is communicating with the PC by reading and writing in a 16 byte area. In this area you can set up the ETM to execute different tasks, depending on the bit pattern in certain memory locations. This is also the place were you can read the settings and values.

The ETM uses a standard serial asynchronous timing format with 1 start bit, 8 data bits (starting with the least significant bit), one parity bit (even parity) and one stop bit. The baud rate is 9600.

There is only one type of message sent from the PC to the ETM:

Write Block:
Depending on a control bit in the first byte of the message this message will result in two different 16 byte answers.
If bit 5 in the control byte is cleared (0) the ETM will overwrite its present 16 byte area with the received data and echo the recently received data back to the PC.
If bit 5 in the control byte is set (1) the ETM will not modify its memory but it will transmit its present 16 byte area back to the PC.

The ETM message block time-out is 100ms. This means all 16 bytes must be transmitted within 100milliseconds. If not, the bytes received so far is ignored.

The ETM run mode time-out is 500ms (120RPM). This means that the ETM will not be able to receive any messages until 500ms after the last synchronisation pulse when the machine stops.

If the checksum and/or the parity bits are incorrect the 16 byte message is **not** written into the ETM. The ETM will, in this case, answer by transmitting its present 16 byte communication area.

This type off message can only be used when the machine is **not** running.

The ETM can send two types of messages to the PC:

Read Block:
This message is a response to a **Write block** message from the PC. The whole 16 byte memory area in the ETM is sent to the PC. The ETM transmits all 16 bytes without any wait time between bytes.

This type off message can only be used when the machine is **not** running.

Runtime Event:
This message consists of three bytes. Two bytes with tension and limit exceed information and one byte with checksum.
If any limit has been exceeded this message contains information on witch one. The message also tells you the binary tension value of the stitch that caused the limit exceed. If a limit has not been exceeded the binary tension value will contain the last executed stitch. The message is enabled/disabled with a control bit in the 16 byte ETM memory area.
It can be selected to be sent after every stitch or only when a indication limit or stop limit is exceeded.
The ETM transmits all 3 bytes without any wait time between bytes.

This type off message can only occur when the machine is running.

ETM communication area

Numerical values are represented in binary form.
Example: High stop limit 413cN is represented as
High stop limit MSB = 0000 0001, High stop limit LSB = 1001 1101.

Byte no:	Contents
0	Command byte (Runtime event options, Memory read/write options, Future address option). **R/W**
1	Limit exceed info bits (Hiind, Loind, Histop, Lostop). Binary tension value (Most significant part). **R**
2	Binary tension value (Least significant part). **R**
3 4	High indication limit, MSB. **R/W** High indication limit, LSB. **R/W** ***1**
5 6	Low indication limit, MSB. **R/W** Low indication limit, LSB. **R/W** ***1**
7 8	High stop limit, MSB. **R/W** High stop limit, LSB. **R/W** ***1**
9 10	Low stop limit, MSB. **R/W** Low stop limit, LSB. **R/W** ***1**
11	***2**
12	***2**
13	Stop filter (no. of stitches in a row out of limits before stop. Allowed values: 1 - 15). **R/W**
14	Range select. (Lowest range: 0-128cN , highest range: 0-1536 cN) **R/W**
15	Checksum. **R/W**

R/W=Read and write possible
R=Read only
***1**= No test performed if contents of register pair is set to zero (= disable limit).
***2**= Reserved for future options.

16 byte messages (Write Block, Read Block):

Byte no. 0: Command byte.
POR (Power On Reset) value: 0000 0000

R/W bit 7	**R/W**	**R/W**	**R/W**	**R/W**	**R/W**	**R/W**	**R/W** bit 0

Bits 4 to 0:
These bits are reserved for future address options.

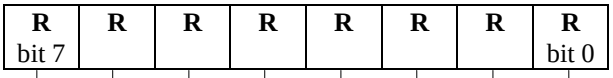
Bit5:
1=Read Area: The contents of a message from the PC will be ignored except this bit. After the reception of the full message the ETM will send the present 16 byte area as it was before the message arrived to the PC.

0=Modify area and echo: The contents of a message from the PC will overwrite the writable parts of the 16 byte area. After the reception of the full message the ETM will echo back the 16 byte modified area to the PC.

Bit7 and 6:
Send runtime message (byte no.1 and byte no.2 and checksum) to PC on conditions.

Bit 7	Bit 6	Action
0	0	The ETM will not send a runtime message to the PC.
0	1	Reserved for future options.
1	0	The ETM will send a runtime message to the PC every time a new stitch is completed. Exceeding a stop limit will cause the ETM to activate message alert output, flash the appropriate LED and stop measuring.
1	1	The ETM will send a runtime message to the PC when a indication limit is crossed or/and when the stop condition according to the stop filter in byte no.13 is satisfied. Exceeding a stop limit will cause the ETM to activate message alert output, flash the appropriate LED and stop measuring.

Byte no. 1: Binary tension value (Most significant part) and limit exceed info bits.
POR value: 0000 0000



Bit 3 to 0:
These bits are the most significant part of the last stitch tension value.

Bit 4:
1= Tension was below the low stop limit during the last seam. (Test result NOT OK) ***3**
0= Tension was above the low stop limit during the last seam. (test result OK) ***3, *4**

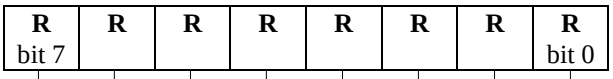
Bit 5:
1= Tension was above the high stop limit during the last seam. (Test result NOT OK) ***3**
0= Tension was below the high stop limit during the last seam. (test result OK) ***3, *4**

Bit 6:
1= Tension was below the low indication during the last seam. (Test result NOT OK) ***3**
0= Tension was above the low indication limit during the last seam. (test result OK) ***3**

Bit 7:
1= Tension was above the high indication limit during the last seam. (Test result NOT OK) ***3**
0= Tension was below the high indication limit during the last seam. (test result OK) ***3**

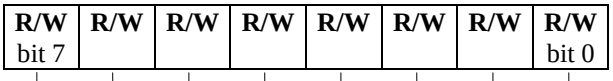
***3** = Test result also depends on stop filter value.
***4** = If, at power up, there has been no RS422 communication prior to the first syncronization pulse both bit 4 and bit 5 will be set.

Byte no. 2: Binary tension value (Least significant part).
POR value: 0000 0000



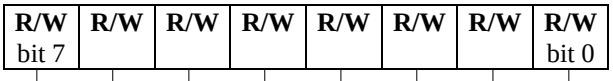
Bits 7 to 0:
This is the least significant part of the last stitch tension value. This byte is updated after every stitch together with byte no:1.

Byte no. 3: High indication limit (Most significant byte).
POR value: 0000 0000



Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 4: High indication limit (Least significant byte).
POR value: 0000 0000



Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 5: Low indication limit (Most significant byte).
POR value: 0000 0000

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 6: Low indication limit (Least significant byte).
POR value: 0000 0000

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 7: High stop limit (Most significant byte).
POR value: 0000 0000

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 8: High stop limit (Least significant byte).
POR value: 0000 0001

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 9: Low stop limit (Most significant byte).
POR value: 1111 1111

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 10: Low stop limit (Least significant byte).
POR value: 1111 1111

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
This is one byte of a two-byte limit value. It must be programmed from the PC at power on.

Byte no. 11: Reserved for future options.
POR value: 0000 0000

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
Reserved for future options.

Byte no. 12: Reserved for future options.
POR value: 0000 0000

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 7 to 0:
Reserved for future options.

Byte no. 13: Stop filter.
POR value: 0000 0001

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bit 3 to 0:
Stop filter value. Example: If set to 3 (bit pattern 0011) the ETM will not activate the message alert line until 3 stitches in a row is outside one of the stop limits. If set to 0 the ETM will never activate the message alert line or send any stop messages to the PC.

Bit 7 to 4:
Reserved for future options.

Byte no. 14: Range select
POR value: 0000 0101 (default range is 0-640 cN)

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bits 4 to 0:
These five bits sets the measuring range. The measuring range must be properly selected by the user to get the optimal resolution on the measured value. In the 0-128 cN range the resolution will be 1cN, in the 0 -1536 cN range it will be 12cN. There is a software limit at 1536cN = bit pattern xxx01100. If a higher value is written in these cells it will be treated as xxx01100. The written value, however will not be changed.
The five bits multiplied with 128 makes the top of the range.
Example:
The bits are set to 5 (bit pattern 00101) 5 x 128 = 640.
The ETM measuring range will be 0 - 640cN.

Bit 7 to 5:
Reserved for future options.

Byte no. 15: Checksum
POR value: 1111 1011 (251 decimal)

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bit 7 to 0:
Checksum is calculated as all bytes from byte no.0 to byte no.14 added without carry and subtracted from 256(decimal).
If the receiver adds all bytes from byte no.0 to byte no.15 (byte no.15 is the checksum) without carry, the result should be zero.

3 byte message (Runtime Event):

First byte: Binary tension value (Most significant part) and limit exceed info bits.
POR value: 0000 0000

R bit 7	R	R	R	R	R	R	R bit 0

Bit 3 to 0:
These bits are the most significant part of the last stitch tension value.

Bit 4:
1= Tension was below the low stop limit during the last seam. (Test result NOT OK) ***3**
0= Tension was above the low stop limit during the last seam. (Test result OK) ***3**

Bit 5:
1= Tension was above the high stop limit during the last seam. (Test result NOT OK) ***3**
0= Tension was below the high stop limit during the last seam. (Test result OK) ***3**

Bit 6:
1= Tension was below the low indication during the last seam. (Test result NOT OK)
0= Tension was above the low indication limit during the last seam. (Test result OK)

Bit 7:
1= Tension was above the high indication limit during the last seam. (Test result NOT OK)
0= Tension was below the high indication limit during the last seam. (Test result OK)

***3**= Test result also depends on stop filter value.

Second byte: Binary tension value (Least significant part).
POR value: 0000 0000

R bit 7	R	R	R	R	R	R	R bit 0

Bits 7 to 0:
This is the least significant part of the last stitch tension value.

Third byte: Checksum
POR value: 0000 0000

R/W bit 7	R/W	R/W	R/W	R/W	R/W	R/W	R/W bit 0

Bit 7 to 0:
Checksum is calculated as first byte and second byte added without carry and subtracted from 256(decimal).
If the receiver adds first byte and second byte and checksum without carry, the result should be zero.

Eltex of Sweden AB
is an innovative company manufacturing and marketing high-technology electronic equipment.
The company was founded in 1964 and has affiliated companies in many countries.
Today, Eltex employ people worldwide.

Eltex of Sweden AB is the market leader in the world of electronic yarn movement detectors for textile machines. We have a large range of control equipment and load limiters for electrical heating systems. Eltex also manufacture data acquisition systems for online operation and small data loggers
for temperature, air humidity, voltage and current.

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