# Eltex Tension Monitor  ETM



## Operating manual
## Eltex Tension Monitor ETM 14500, 14501
## for quilting machines

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OF SWEDEN

# Operating Manual for Eltex Tension Monitor system, ETM

## for quilting machines

### Model 14500 for lock stitch machines

The **Eltex Tension Monitor (ETM) 14500** is an on-line device for quilting machines. It monitors the thread tension on the top thread. The monitor also acts as a thread break detector for the top thread. It enables the operator to keep the thread tension within the desired tension range for best operation and quality of the seam.

The ETM indicates, with LEDs, if the thread tension is outside the selected Indication Limits. If the thread tension exceeds the selected Stop Limits, the ETM will send a stop signal to the machine.

Monitor limits are easily set and checked on the central control unit through standard code switches.

The monitors are factory-calibrated. No manual reset is required.

If a pattern with discontinued seam is used, there is a possibility to shut off monitoring during jump sequence. The central control unit has an optocoupler isolated input for this purpose.

A system consists of one central control unit and a number of monitors. The central control unit needs a synchronisation pulse from the main shaft. It could be created with a proximity switch. The stop signal is generated on a relay output at the central control unit.

### Model 14501 for chain stitch machines

For chain stitch machines you should use the **14501 model with bottom thread detection**. The 14501 model needs an extra synchronisation pulse from the main shaft. This pulse is used for the bottom thread detection.

The bottom thread detection is a separate function where variations in the top thread tension is used to detect a bottom thread failure. A Bottom Thread Detector Limit is set to decide if the bottom thread is present or not.
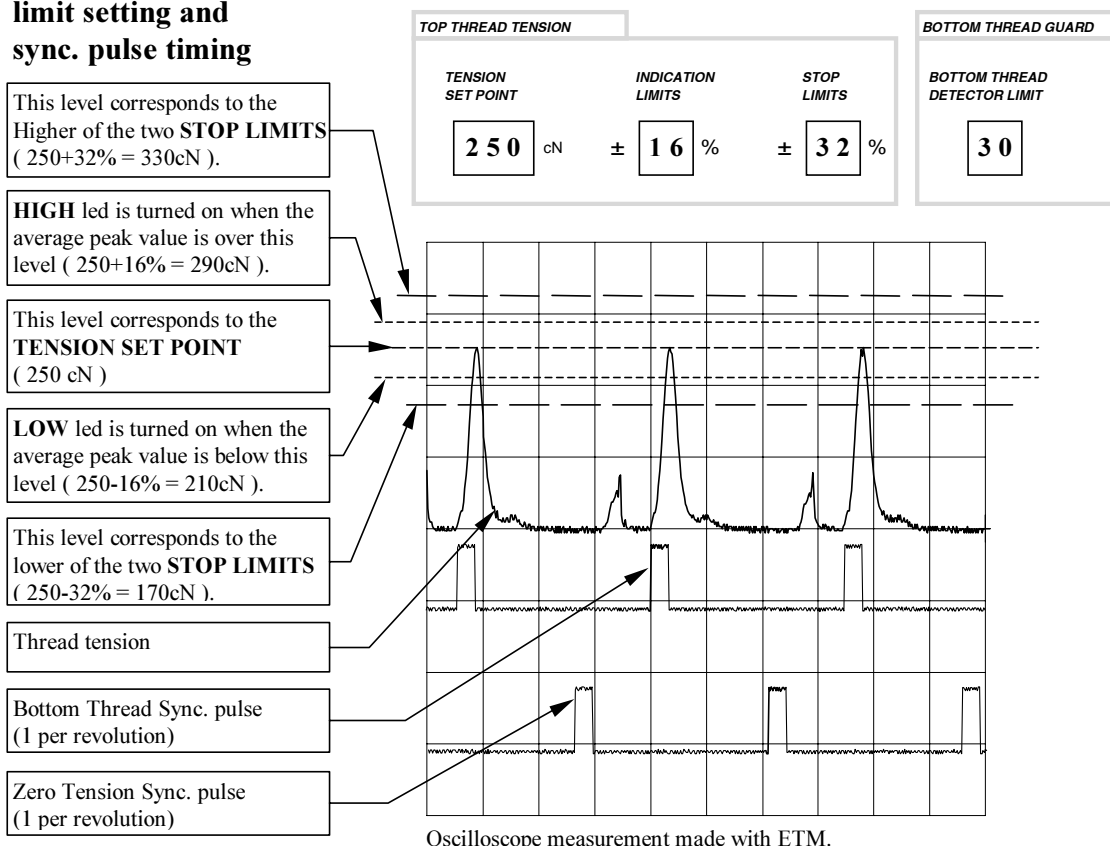
# Fitting

1. The monitors should be mounted on a DIN-rail. The DIN-rail should be mounted using anti vibration pads to absorb mechanical shocks and vibrations from the machine. Fit the monitors after the existing thread tensioners. The thread must not be deflected sideways between the monitor and the needle. If the thread is deflected too much, the tension measurement and bottom thread break detection may not work properly.

2. Fit the Central control unit (14100) so that it is possible to watch the LEDs on the monitors and adjust the code switches on the central control unit at the same time.

3. To synchronise the monitors to the machine 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 system needs a pulse at a certain moment every revolution. On a chain stitch machine you need two separate proximity switches to be able to use the bottom thread detection as well.

   The Zero Tension Sync. input should get a positive edge (high logic level voltage = 6.0–30 VDC) when the thread tension is as close to zero as possible. This normally occurs when the pull back arm has travelled 2/3 towards the lowest position. The length of this sync. pulse is of little importance.

   On chain stitch machines with the 14501 the Bottom Thread Sync. should get a positive edge (logic level as above) just at the moment when the pullback arm is starting to tighten the knot in the fabric. The negative edge should come a moment before the knot is finished. The Bottom Thread Sync. pulse should be very short, typically 10–30% of one revolution. We recommend you to get assistance of a qualified Eltex service technician if you fail to get the bottom thread break detection working properly.

   These timings are very important to get the ETM to work properly.

**Example showing limit setting and sync. pulse timing**

| TOP THREAD TENSION | | | BOTTOM THREAD GUARD |
|---|---|---|---|
| **TENSION SET POINT** | **INDICATION LIMITS** | **STOP LIMITS** | **BOTTOM THREAD DETECTOR LIMIT** |
| **2 5 0** cN | ± **1 6** % | ± **3 2** % | **3 0** |

This level corresponds to the Higher of the two **STOP LIMITS** ( 250+32% = 330cN ).

**HIGH** led is turned on when the average peak value is over this level ( 250+16% = 290cN ).

This level corresponds to the **TENSION SET POINT** ( 250 cN )

**LOW** led is turned on when the average peak value is below this level ( 250-16% = 210cN ).

This level corresponds to the lower of the two **STOP LIMITS** ( 250-32% = 170cN ).

Thread tension

Bottom Thread Sync. pulse (1 per revolution)

Zero Tension Sync. pulse (1 per revolution)

Oscilloscope measurement made with ETM.

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# Wiring

1. Connect all monitors using the black high flex 10-p. cable. Do not stretch the cable between the monitors. It is better to leave a soft bend on the cable to take up vibrations.

2. Connect the black high flex 10-p. cable to the central control unit using shielded 10p. flat cable. The shield should be connected to the chassis of the central control unit. Use the clamp at the bottom metal plate. Leave the shield unconnected in the other cable end.

3. Connect the synchronisation devices, for example two proximity switches. The proximity switch output should be connected to the synchronising inputs. Connect the proximity switches to supply and ground. We recommend the use of a PNP, normally open proximity switch. 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.

4. Connect the stop relay output to the machine. The stop signal is normally used to open up a self holding relay circuit or supplying a stop input on a machine control input.

   Use pin 1 and 3 if you want to break a connection at stop, or

   Use pin 2 and 3 if you want to make a connection at stop.

   The stop relay is activated for approx. 2 seconds at stop condition and will then go back to passive state.

5. If you need to run patterns with jumping sequences you must connect the jump input. This input is optocoupler isolated. To disable the monitors, put a voltage (10–30 Vdc) on the Monitor disable input. Please note the polarity when connecting this input.

6. Connect the central control unit transformer to the mains according to the label in the central control unit box (see "Typical connection in central control unit").

# Setting procedure

1. Begin with temporarily setting these values:

   | | |
   |---|---|
   | **TENSION SET POINT:** | **150 cN** |
   | **INDICATION LIMITS:** | **0 %** |
   | **STOP LIMITS:** | **0 %** |
   | **BOTTOM THREAD DETECTOR LIMIT:** | **0** |

2. Set the thread tensioners to the desired tension. Check the seam and make sure the machine works as intended.

3. Search the thread tension that the machine is using like this:

   Adjust **TENSION SET POINT** while sewing until approximately half the monitors are indicating too high tension and the other half are indicating too low tension. Increase the value if too many HIGH LEDs are on; decrease the value if too many LOW LEDs are on.

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4. Set **INDICATION LIMITS** to a suitable value (most applications use about 10–20%). This value determines how much the measured value can differ from the set value without any of the LEDs indicating.

5. Set **STOP LIMITS** to a suitable value (for example 20 units higher than the INDICATION LIMITS value). The stop signal will be activated and the LOW LED or HIGH LED will flash when the thread tension goes below or above the STOP LIMITS value.

6. For chain stitch machines with 14501:

   Set the **BOTTOM THREAD DETECTOR LIMIT** on 99, and decrease the value until the machine makes a false stop and the monitor indicates bottom thread error by flashing both LEDs, one at a time. Increase the BOTTOM THREAD DETECTOR LIMIT step by step, until the machine does not perform any false stops.

   **Remember:**

   **Increased value = increased risk of missing a real bottom thread error.**

   **Decreased value = increased risk of false stops.**

7. Jumping sequence enable / disable switch.

   On the central control unit there is a small 4 position DIL switch. If you set switch number 1 to ON (push upwards), you can use the Monitor Disable input. If the switch is set to OFF, the Monitor Disable input will be ignored. Read more about this in the START DELAY section.

# Working with the ETM

Once you are satisfied with the settings you can operate the machine just as normal. With a glance at the LEDs now and then, you can easily check if the tension is in the selected range or if the thread tensioners has to be adjusted. If the HIGH LED is on, loosen the thread tensioner. If the LOW LED is on, tighten the thread tensioner.

If you do not have the time or the possibility to check the LEDs all the time, just let the STOP LIMITS function stop the machine when the tension goes out of the selected range. The machine will stop and the LOW LED will flash if the tension was to low or the HIGH LED will flash if the tension was too high. Adjust the thread tensioner or find other possible reasons why the thread tension has changed. The LED will continue flashing until the machine is started again.

If the thread tension exceeds 420cN, the ETM will indicate overload by rapidly flashing the HIGH LED and giving a stop pulse. The LED will continue flashing until the machine is restarted.

## LED flash codes

The two LEDs on the front of the monitor can flash in different ways:

| | |
|---|---|
| Top | ☼ ——— ⌃ |
| | ● |
| Bottom | ● |
| | ☼ ——— ⌄ |
| Top | ☼ — — ⌃ |
| | ● |
| Top | ☼ - - - - ⋀ |
| | ● |
| Bottom | ● |
| | ☼ — — ⌄ |
| Top | ☼ - - |
| Bottom | ☼ — — —✕— |

- Steady light at the top LED = Thread tension is above the high indication limit.

- Steady light at the bottom LED = Thread tension is below the low indication limit.

- Flashing light at the top LED = Thread tension is above the high stop limit.

- Very fast flashing light at the top LED = Thread tension is above the maximum for this type of sensor (overflow).

- Flashing light at the bottom LED = Thread tension is below the low stop limit.

- Both LEDs are flashing, one at a time. The top one short time and the bottom one a longer time = Bottom thread broken or not present.

# Start delay

When using the ETM-quilt central control unit, with the DIL switch number 1 in position OFF there will be a start delay generated by the monitors. During this delay the yellow led in the monitor button flashes. This indicates that there is no monitoring during this time. The time is approx. 5 seconds.

If the DIL switch number 1 is in the ON position there will be no start delay generated from the ETM system. In this case the user should make sure that the machine computer provides the start delay through the Monitor disable input.

# Jumping

When sewing a pattern with discontinued seam, the Monitor Disable function should be used. This mode is selected by setting DIL switch no. 1 on the central control unit to the ON position. You should use the Monitor Disable function to shut off the monitors while the machine is slowing down before a jump sequence, during the jump sequence and during the first stitches at the beginning of the seam after a jump sequence. The thread tension during these phases, are very unstable and will cause the monitor system to give false alarms.

# About the measuring principle

The ETM measures the peak value of the thread tension in every stitch. A floating average routine is used for the indicator LEDs to reduce flicker. It takes approximately 20 stitches to get the true indication after a big change in thread tension.

The STOP LIMITS function is using the same floating average value. If the average thread tension exceeds the range selected at the STOP LIMITS setting during 3 stitches in a row, the stop output will be activated. The HIGH LED will flash if the high limit has been exceeded and LOW LED will flash if the low limit has been exceeded.

# Characteristics

## for the Eltex Yarn Tension Monitor system, Quilting machine model

## Monitor 14500/14501:

Typical current consumption ........................................... 12.5 mA

Speed range ................................................................. 80–5 000 RPM

Working ambient temperature range ................................ 15–45°C (60–110°F)

Monitor dimensions (width x height x depth) ..................... 25 x 81 x 91 mm

## Central Control Unit 14100:

Supply voltage ............................................................... 230 V AC or 400 V AC

Central control unit maximum current consumption ......... 250 mA at 230 V AC

Max number of monitors per central control unit .............. 160

Maximum current trough stop relay ................................. 2 A (AC or DC)

Maximum voltage at stop relay output ............................. 50 V DC or 75 V AC

Maximum voltage at Synchronization inputs ..................... 30 V DC      $V_{in}$low: 0–1.2 V

                                                                                                      $V_{in}$high: 6.0–30 V

Maximum voltage at Monitor Disable input ....................... 30 V DC      $V_{in}$low: 0–1.0 V

                                                                                                      $V_{in}$high: 10–30 V

Output Stop pulse length ................................................ approx. 2 seconds

Working ambient temperature range ................................ 15–45°C (60–110°F)

Central control unit dimensions (width x height x depth) ... 176 x 250 x 105 mm

We reserve the right to modify the design.

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# Typical Application:



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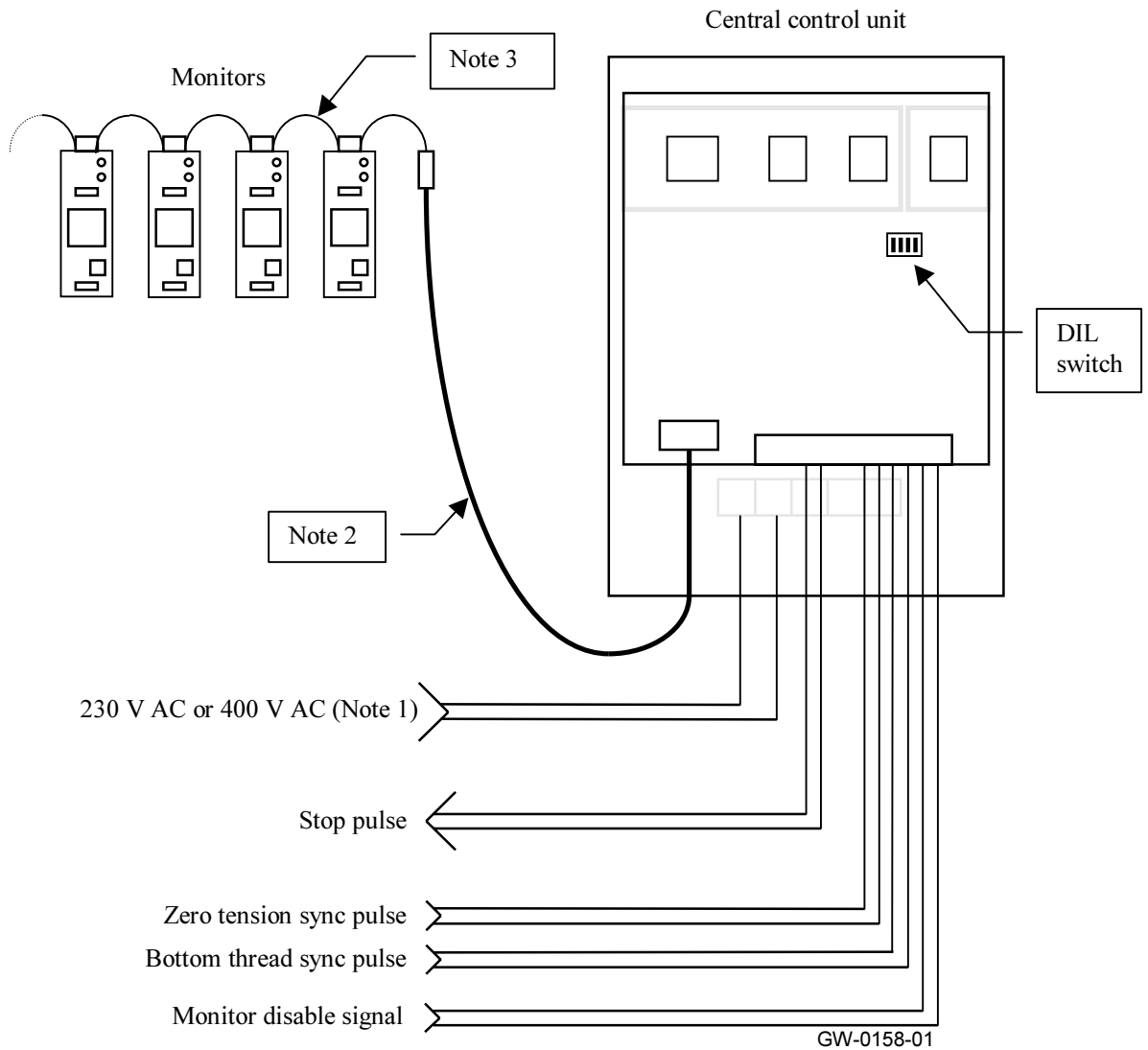
## Notes:

Note 1:  Different supply voltages is possible by connecting the central control unit transformer in other manners (see label in central control unit housing).
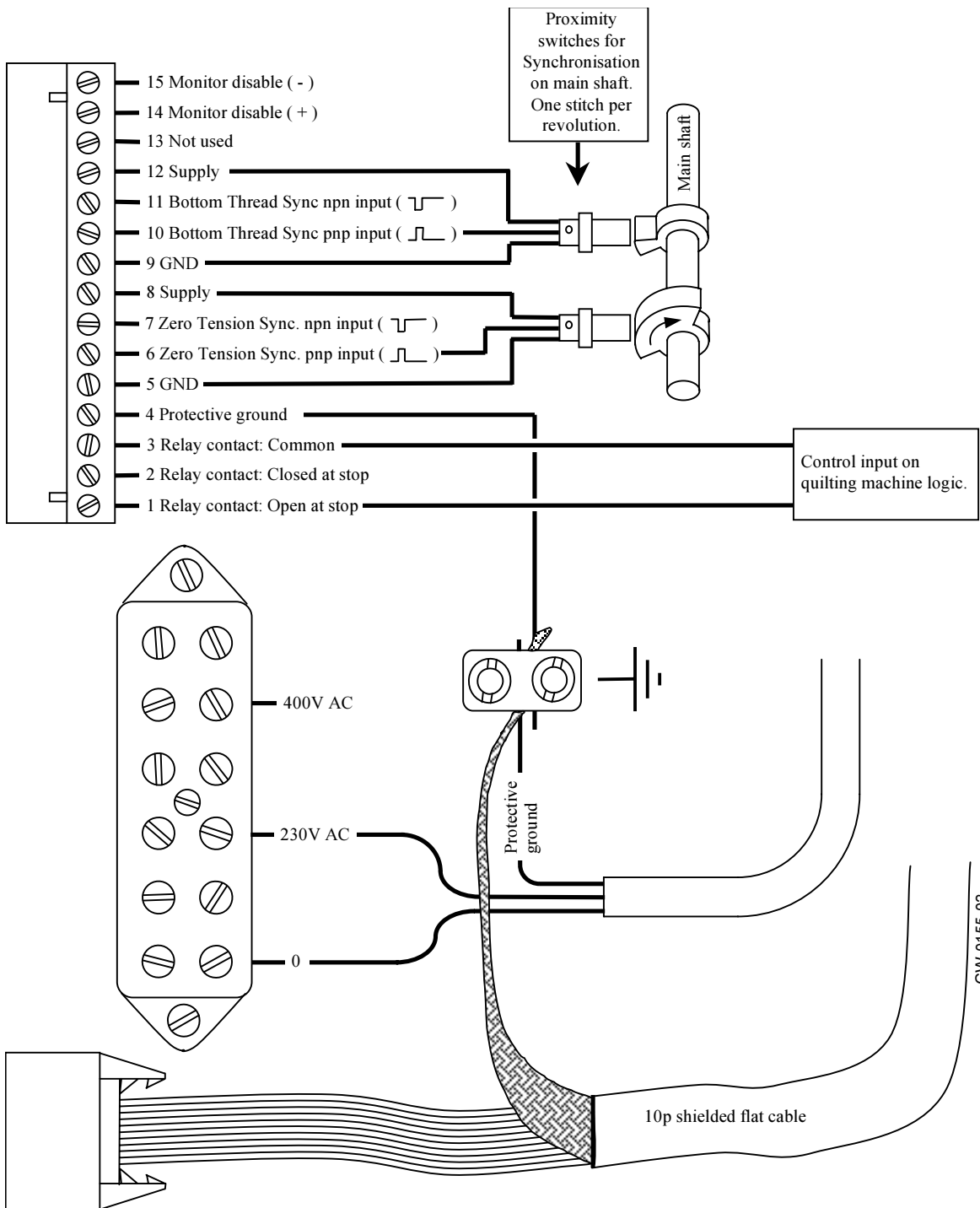
Note 2:  This cable should be shielded 10p flat cable with the shield connected to protective ground in the central control unit only.

Note 3:  This cable should be 10p high flexible flat cable.

## DIL switch

Is described on page 5 under **Start delay** and **Jumping**.

# Typical connection in central control unit:



Proximity switches for Synchronisation on main shaft. One stitch per revolution.

Main shaft

15 Monitor disable ( - )
14 Monitor disable ( + )
13 Not used
12 Supply
11 Bottom Thread Sync npn input ( ⎍ )
10 Bottom Thread Sync pnp input ( ⎍ )
9 GND
8 Supply
7 Zero Tension Sync. npn input ( ⎍ )
6 Zero Tension Sync. pnp input ( ⎍ )
5 GND
4 Protective ground
3 Relay contact: Common
2 Relay contact: Closed at stop
1 Relay contact: Open at stop

Control input on quilting machine logic.

400V AC

230V AC

0

Protective ground

10p shielded flat cable

GW-0155-02

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**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.

Eltex of Sweden is the market leader in the world of electronic
yarn movement detectors and yarn tension monitors 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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