ENG

# T-two

## Tension control with load cells or dancer roll

**USER'S MANUAL**

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# Warnings

The present manual is for device fitters and operators. It provides indications on the intended use of the device, technical specifications and instructions for installation, adjustment and use.
This manual is an integral part of the device and must be kept until the device is decommissioned. It reflects the technical state of the device at the time of its sale.
The plant builder may include the present manual in the documentation for plant use.
Re S.p.A. reserves the right to update its production and/or manuals without updating products already sold and previous manuals.
Since the device forms part of a plant, the plant builder is responsible for ensuring that all parts comply with the laws in force in the country in which it is installed.
The device must be fitted and adjusted by qualified technical personnel.
It may be moved manually.

## Information about device recovery

The device bears a clear, visible and indelible indication allowing identification of the manufacturer and the separate collection symbol (symbol on side).
This symbol, showing a wheelie bin with a cross through it, unequivocally indicates that the device was released after 13.08.2005 and that it must be subject to separate collection.

- **In European Union member states**

  The device falls within the electrical and electronic equipment category, which must be disposed of not amongst undifferentiated urban waste, but through separate collection. Therefore, at the end of the device's lifetime, it must be disposed of in conformity with the European standards adopted in the member state in which it was installed.

  WEEE (Waste Electrical and Electronic Equipment) may be intended for individual, collective or mixed collection and recovery systems at designated centres (for more information contact the relevant local authorities) or may be returned to the distributor when a new item of equipment is purchased. This eliminates or reduces potentially negative effects on the environment deriving from improper use of the equipment or parts of it.
  For correct waste management, the relevant authorities promote the reduction of final waste disposal by means of re-use, recycling and other forms of recovery to obtain raw materials from waste.

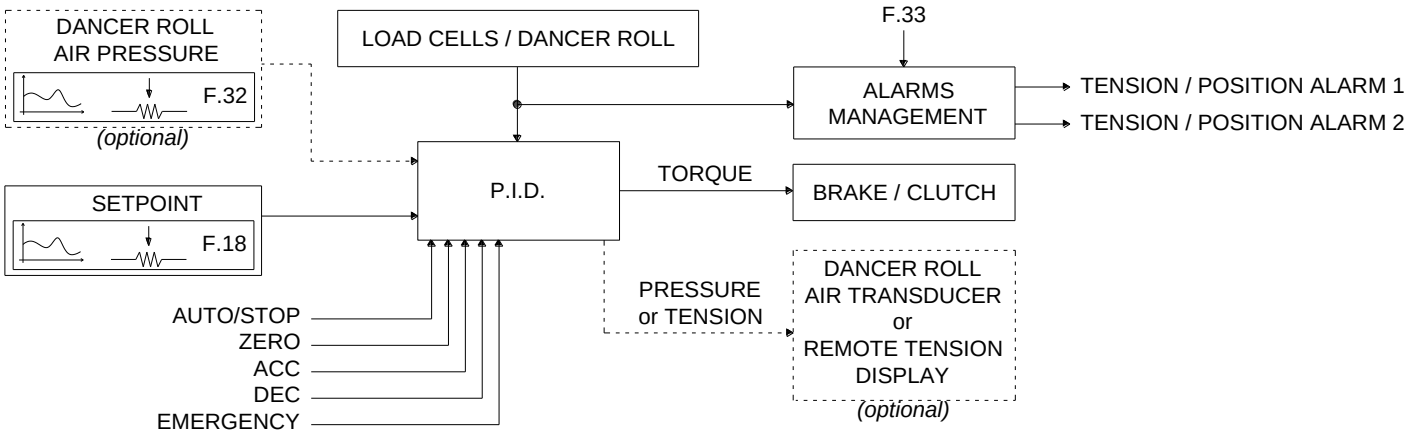
  In the event of illegal disposal of WEEE, offenders will be punished in accordance with the sanctions established by the member state in which it was installed.

- **In non-EU countries**

  Recovery and final disposal of the device must be carried out in conformity with the standards in force in the country in which it was installed. It may be advisable to take into account the information provided regarding European Union member states.

# Detailed description of the application

The following is a functional block diagram of the **T-two** device application:



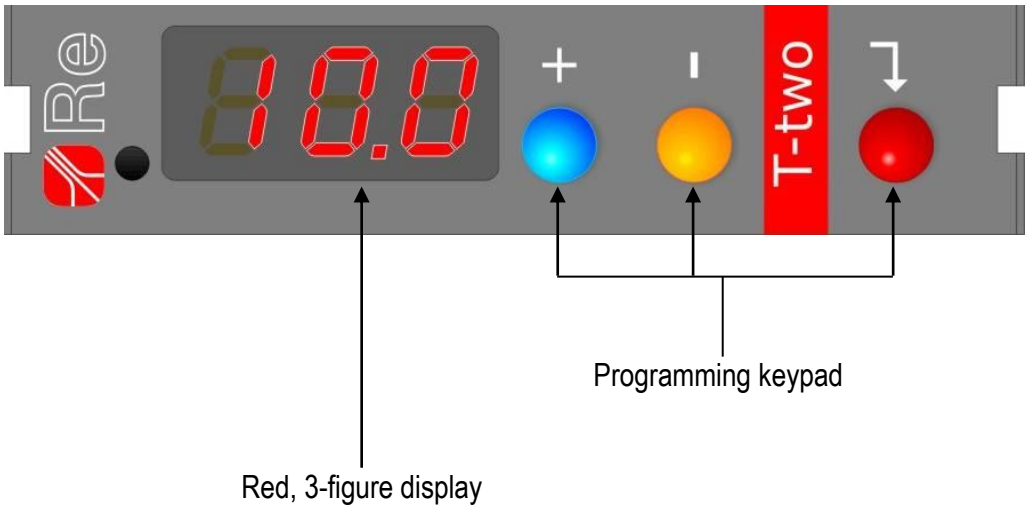

The **T-two** regulator uses an automatic tension control system for torque regulated winding/unwinding systems fitted with load cells or dancer rolls. The torque, which is transferred to the reel via a brake (pneumatic or electro-magnetic) or clutch, is regulated by the **PID** algorithm in order to maintain the tension applied to the material (or the position of the dancer roll) constant at the setpoint. The setpoint is set-up locally using function **F.18** (if **F.38 = OFF**) or remotely (if **F.38 = On**), using a potentiometer or an analogue signal from the PLC, for example.

When the dedicated digital input is activated, causing the regulator to switch from the STOP to the AUTO state, the regulation begins to apply a torque value that may be either the value set-up using function **F.1** (if **F.48 = OFF**) or the last value that was applied in AUTO mode (if **F.48 = On**). If the STOP→AUTO state transition occurs after the instrument has been set to the ZERO state in order to change the reel, the regulator will restart at the torque value set-up in **F.1**, irrespective of the **F.48** setting; this also happens if the instrument is disconnected from its power supply.

The regulator monitors the tension (or the position of the dancer roll) continuously and if any of the alarm limits are exceeded the corresponding digital outputs on the **T-two** unit are activated; this enables external devices, such as the PLC, to detect any fault conditions.

**T-two** is equipped with an auxiliary analogue output that can be used to control an external display device or, when using a dancer roll to regulate the tension, the transducer that regulates the air pressure in the dancer roll piston; this pressure value may be set-up locally using function **F.32** (if **F.40 = OFF**) or remotely (if **F.40 = On**), for example by converting the analogue signal from a potentiometer of the PLC.

# Interface




The **T-two** unit features two separate configuration menus: The first menu is identified by the initials **P.0** and includes all the functions necessary for setting up the device hardware, whereas the second, which is identified by the initials **P.1**, can be used to set-up the tension regulator operating parameters.
When the user selects a menu without accessing it, the display indicates some useful additional information about the selected menu. To select the menu, press and hold the ↵ key for approximately 3 seconds the letter **P.** Appears on the display, followed by the menu identification number; press the **+** / **–** keys to scroll to the desired menu, then press ↵ to select it and continue pressing to access the functions menu.

## Information indicated on the display

The following table lists the information that may appear on the display, depending on which menu has been selected.

| Key pressed | Menu P. 0 | Menu P. 1 |
|---|---|---|
| None | Firmware Version | Tension (kg)/Position (%) |
| + | - | Setpoint |
| – | - | PID regulator state * |
| + and – | - | - |
| ↵ and + | Current (A) supplied by AO3 | - |

* For a list of the states, see the table on page 4

# Remote control of the states by PLC

The **T-two** unit is equipped with four digital inputs that are used to control the state of the regulator.
For a detailed description of the operating logic used to activate these inputs (closure of a 24Vdc contact) see the paragraph *Remote control of states by PLC* in the unit installation manual.
It is important to note that the **EMERGENCY** remote command is a "virtual" function only and does not correspond to any of the physical inputs and is activated only if both the ACC and DEC remote contacts are active, as illustrated in diagram 1 below.
By using the ACC (**F.6**) and DEC (**F.11**) state delays it is possible use a different set of parameters, for a predetermined period, in order to optimise the way the system reacts to the during the start and stop phase transients using nothing more than the AUTO/STOP remote command.

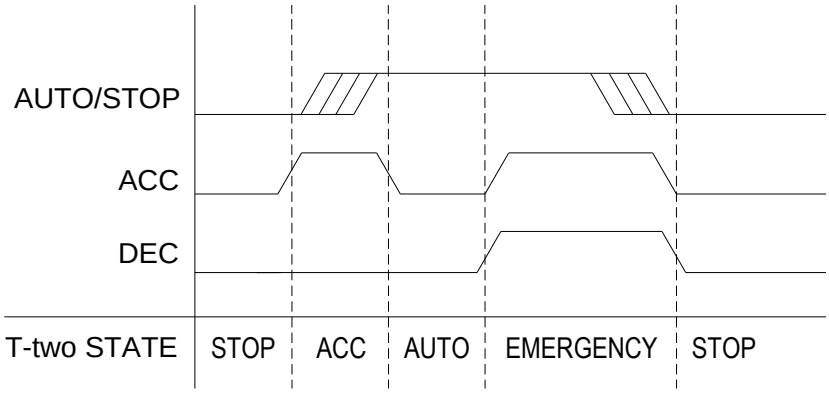



*Diagram 1: AUTO/STOP and REEL SELECTION command functions*

## Regulator states

| Display indication | State | Description |
|---|---|---|
| **-S-** | STOP | Machine stationary |
| **-AU** | AUTO | Machine operating at working speed |
| **-AC** | ACC | Machine in acceleration phase |
| **-d-** | DEC | Machine in deceleration phase |
| **-0-** | ZERO | Machine stationary + Reel released |
| **-E-** | EMERGENCY | Machine in rapid stop phase |

# Setting up the regulator

The following is a brief summary of the functions that are available for setting up the tension regulator. For a complete description, consult *Detailed description of the regulator set-up and parameters menu (P.1)* on page 7.

To access the set-up environment press and hold the ↵ for approximately 3 seconds. The letter **P.** Appears on the display, followed by the menu identification number. Press the **+** / **–** keys to scroll to the regulator set-up and parameters menu "P.1". Press and hold the ↵ key again to access the menu. The display indicates the letter **F.** followed by the number that identifies the first available function.

Use the **+** / **–** keys to scroll through the list of programming functions.

To modify the parameters associated with each individual function, select the desired function, then press the ↵ key: The display indicates the current parameter value. Use the **+** / **–** to set the desired value, then press the ↵ key to confirm.

To save the new settings, select the first function in the menu and press the **–** key, or select the last function and press the **+** key, after approx. 3 seconds the unit will exit the menu and the data will be saved.

## Regulator set-up and parameters menu (P.1)

| Function ID | Description | Parameter name | Range | Factory value |
|---|---|---|---|---|
| **F.1** | Torque in STOP state (%) | STOP_OUT | 0.0÷99.9 | 10.0 |
| **F.3** | "Proportional" regulator in AUTO state | AUTO_P | 0.0÷99.9 | 2.0 |
| **F.4** | "Integral" regulator in AUTO state | AUTO_I | 0.00÷9.99 | 0.80 |
| **F.5** | "Derivative" regulator in AUTO state | AUTO_D | 0.00÷9.99 | 0.00 |
| **F.6** | ACC delay state(s) | ACC_TIME | 0÷100 | 0 |
| **F.7** | "Proportional" regulator in ACC state | ACC_P | 0.0÷99.9 | 2.5 |
| **F.8** | "Integral" regulator in ACC state | ACC_I | 0.00÷9.99 | 0.40 |
| **F.9** | "Derivative" regulator in ACC state | ACC_D | 0.00÷9.99 | 0.00 |
| **F.11** | DEC delay state(s) | DEC_TIME | 0÷100 | 0 |
| **F.12** | "Proportional" regulator in DEC state | DEC_P | 0.0÷99.9 | 2.5 |
| **F.13** | "Integral" regulator in DEC state | DEC_I | 0.00÷9.99 | 0.40 |
| **F.14** | "Derivative" regulator in DEC state | DEC_D | 0.00÷9.99 | 0.00 |
| **F.16** | "Proportional" regulator in STOP state | STOP_P | 0.0÷99.9 | 0.0 |
| **F.17** | "Derivative" regulator in STOP state | STOP_D | 0.00÷9.99 | 0.00 |
| **F.18** | Setpoint (Tension/Position) | SETPOINT | 0÷FS | 25 |
| **F.19** | Torque in EMERGENCY state (%) | EMERGENCY_OUT | 0.0÷99.9 | 60.0 |
| **F.32** | Dancer roll air pressure (%) | DANCER_PRESSURE | 0.0÷99.9 | 0.0 |
| **F.33** | Tension/position alarm modes | ALARMS_MODE | OFF<br>A-b<br>b-A<br>A-A<br>b-b | b-A |

| | | | | |
|---|---|---|---|---|
| **F.34** | Tension/position alarm 1 threshold | ALARM1_THRESHOLD | 0÷FS | 5 |
| **F.35** | Tension/position alarm 2 threshold | ALARM2_THRESHOLD | 0÷FS | 45 |
| **F.36** | Tension/position reading filter | TENSPOS_FILTER | 0÷100 | 80 |
| **F.37** | Decimal point position | DECIMAL_PLACES | 0<br>0.1<br>0.02 | 0 |
| **F.38** | Remote setpoint acquisition | SETPOINT_ACQ_MODE | OFF/On | OFF |
| **F.39** | Remote setpoint filter | SETPOINT_FILTER | 0÷100 | 80 |
| **F.40** | Remote dancer roll air pressure acquisition | PRESSURE_ACQ_MODE | OFF/On | OFF |
| **F.41** | Remote dancer roll air pressure filter | PRESSURE_FILTER | 0÷100 | 80 |
| **F.48** | Enable/disable last torque value used in AUTO mode to be retained in STOP mode | USE_LASTAUTOINT_STOP | OFF/On | On |
| **F.97** | Enter “Admin” password | - | 0÷999 | 0 |
| **F.98** | Save “Admin” password | PASSWORD_LEV2 | 0÷999 | 0 |

# Detailed description of the regulator set-up and parameters menu (P.1)


The functions preceded by this symbol are valid for applications with dancer rolls only.


The functions preceded by this symbol are valid for applications with load cells only.

**Function 1 – Torque in STOP state (%)**

You can use this function to set-up the percentage of torque applied to the reel when the machine is stationary (STOP).

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired torque value, expressed as a percentage.

Press ↵ to confirm.

**Function 3 – "Proportional" regulator in AUTO state**

This parameter, together with the integral and derivative parameters, acts on the regulation when the machine is operating at the working speed (AUTO state). Increase the value of the proportional parameter to increase the system response speed so that it reaches the setpoint value more rapidly. If the speed is too high the system could become unstable, resulting in excessive tension (setpoint exceeded) and harmful oscillations.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired value.

Press ↵ to confirm.

**Function 4 – "Integral" regulator in AUTO state**

This parameter, together with the proportional and derivative parameters, acts on the regulation when the machine is operating at the working speed (AUTO state). Decrease the value of the integral parameter to increase the speed at which the regulator corrects the error at the working speed, so that it reaches the setpoint value more rapidly. If the integral parameter value is set too low the system could become unstable, causing the tension to oscillate continuously around the setpoint value, without ever reaching a stable state.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired value.

Press ↵ to confirm.

**Function 5 – "Derivative" regulator in AUTO state**

This parameter, together with the proportional and integral parameters, acts on the regulation when the machine is operating at the working speed (AUTO state). Increase the value of the derivative parameter to improve the capacity of the regulator to predict the error trend and compensate for sudden variations in the tension; it is also capable of damping the undesired effects caused by a high proportional value. If the derivative parameter value is set too high the system may become highly sensitive, reacting to even the smallest variations at the input (interference) and resulting in harmful oscillations.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired value.

Press ↵ to confirm.

**Function 6 – ACC delay state**

You can use this function to set-up a time interval, expressed in seconds, following the instant the STOP→AUTO command is activated, during which the regulator enters the ACC (acceleration) state, before switching automatically to the AUTO state. Use the **F.7**, **F.8** and **F.9** functions to modify the behaviour of the regulator during the machine acceleration phase.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired delay period.

Press ↵ to confirm.

If this function is enabled, by setting the time to a value other than 0, it automatically prevents the remote ACC command from being activated.

**Function 7 – "Proportional" regulator in ACC state**

This parameter, together with the integral and derivative parameters, acts on the regulation when the machine is in the acceleration phase (ACC state).

Refer to **F.3** for a description of the parameter.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired value.

Press ↵ to confirm.

**Function 8 – "Integral" regulator in ACC state**

This parameter, together with the proportional and derivative parameters, acts on the regulation when the machine is in the acceleration phase (ACC state).

Refer to **F.4** for a description of the parameter.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired value.

Press ↵ to confirm.

**Function 9 – "Derivative" regulator in ACC state**

This parameter, together with the proportional and integral parameters, acts on the regulation when the machine is in the acceleration phase (ACC state).

Refer to **F.5** for a description of the parameter.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired value.

Press ↵ to confirm.

**Function 11 – DEC delay state**

You can use this function to set-up a time interval, expressed in seconds, following the instant the AUTO→STOP command is activated, during which the regulator enters the DEC (deceleration) state, before switching automatically to the STOP state. Use the **F.12**, **F.13** and **F.14** functions to modify the behaviour of the regulator during the machine deceleration phase.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired delay period.

Press ↵ to confirm.

If this function is enabled, by setting the time to a value other than 0, it automatically prevents the remote DEC command from being activated

**Function 12 – "Proportional" regulator in DEC state**

This parameter, together with the integral and derivative parameters, acts on the regulation when the

machine is in the deceleration phase (DEC state).
Refer to **F.3** for a description of the parameter.
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired value.
Press ↵ to confirm.

**Function 13 – "Integral" regulator in DEC state**

This parameter, together with the proportional and derivative parameters, acts on the regulation when the machine is in the deceleration phase (DEC state).
Refer to **F.4** for a description of the parameter.
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired value.
Press ↵ to confirm.

**Function 14 – "Derivative" regulator in DEC state**

This parameter, together with the proportional and integral parameters, acts on the regulation when the machine is in the deceleration phase (DEC state).
Refer to **F.5** for a description of the parameter.
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired value.
Press ↵ to confirm.

**Function 16 – "Proportional" regulator in STOP state**

This parameter, together with the derivative parameter, acts on the regulation when the machine is stationary (STOP state).
Refer to **F.3** for a description of the parameter.
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired value.
Press ↵ to confirm.

**Function 17 – "Derivative" regulator in STOP state**

This parameter, together with the proportional parameter, acts on the regulation when the machine is stationary (STOP state).
Refer to **F.5** for a description of the parameter.
Press ↵to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired value.
Press ↵ to confirm

**Function 18 – Tension (kg)/Position (%) setpoint**

You can use this parameter to set-up the desired material tension (in kg) or the position where the dancer roll is to be maintained (as a percentage).
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired tension or position.
Press ↵ to confirm.

**Function 19 – Torque in EMERGENCY state (%)**

You can use this function to set-up the percentage of torque applied to the reel when the machine is forced to perform a rapid stop (EMERGENCY state). To activate the EMERGENCY state, use the

dedicated remote command as described in *Remote control of the states by PLC* on page 4.
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired torque value, expressed as a percentage.
Press ↵ to confirm.

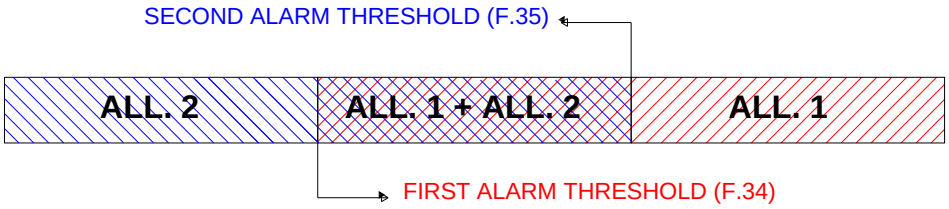
## Function 32 – Dancer roll air pressure (%)

If the transducer that supplies the air to the dancer roll piston has been connected to the **T-two** unit via the dedicated analogue control output, you can use this function to set-up the air pressure and hence the material tension (as a percentage).
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired pressure value, expressed as a percentage.
Press ↵ to confirm.

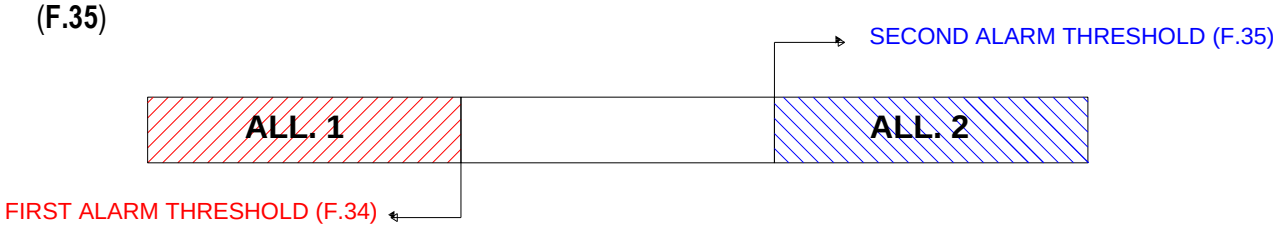
## Function 33 – Tension/Position alarms mode

You can use this function to configure how the tension/position alarms are activated.
**N.B.:** The hysteresis effect on the alarms thresholds is 3%.
Press ↵ to access the function, the display indicates the currently selected activation mode.
Press **+** / **–** to select the desired activation mode:

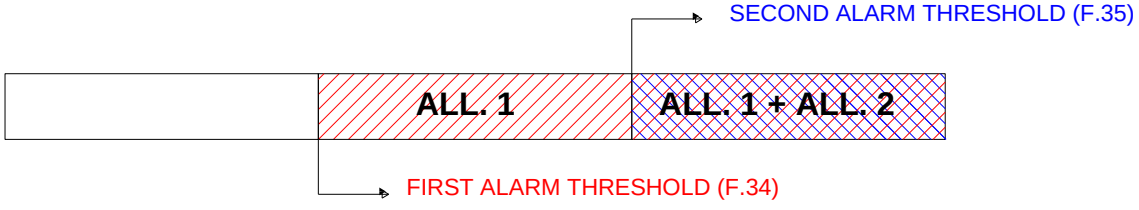
- **OFF**: both alarms are deactivated
- **A-b**: Alarm 1 is activated when the tension (or the position) exceeds the alarm 1 threshold (**F.34**) whereas Alarm 2 is activated when the tension (or the position) falls below the alarm 2 threshold (**F.35**)



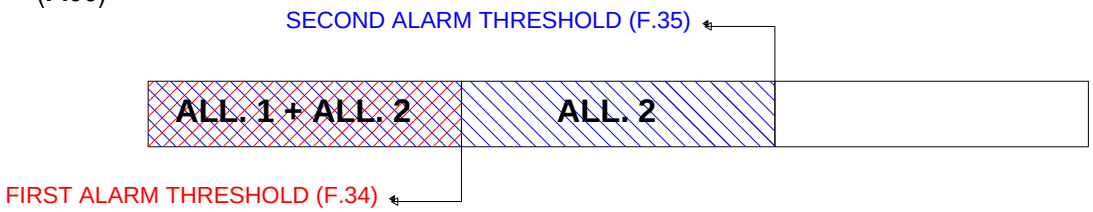

- **b-A**: Alarm 1 is activated when the tension (or the position) falls below the alarm 1 threshold (**F.34**) whereas Alarm 2 is activated when the tension (or the position) exceeds the alarm 2 threshold (**F.35**)




- **A-A**: Alarm 1 is activated when the tension (or the position) exceeds the alarm 1 threshold (**F.34**) whereas Alarm 2 is activated when the tension (or the position) exceeds the alarm 2 threshold (**F.35**)



- **b-b**: Alarm 1 is activated when the tension (or the position) falls below the alarm 1 threshold (**F.34**) whereas Alarm 2 is activated when the tension (or the position) falls below the alarm 2 threshold (**F.35**)




Press ↵ to confirm.

**Function 34 – Tension/Position alarm 1 threshold**

You can use this function to set-up an alarm threshold that corresponds to the tension (kg) or dancer roll position (%) value where the corresponding digital output is activated (by closing the relay contact), in accordance with the activation mode selected using function **F.33**.

**N.B.:** The hysteresis effect on the alarms thresholds is 3%.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired threshold value.

Press ↵ to confirm.

**Function 35 – Tension/Position alarm 2 threshold**

You can use this function to set-up a second alarm threshold that corresponds to the tension (kg) or dancer roll position (%) value where the corresponding digital output is activated (by closing the relay contact), in accordance with the activation mode selected using function **F.33**.

**N.B.:** The hysteresis effect on the alarms thresholds is 3%.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired threshold value.

Press ↵ to confirm.

**Function 36 – Tension/Position reading filter**

During normal operation, the unit displays the acquired tension or position value, depending on the application. To make it easier for the user to read this value, particularly in the case of applications that use load cells, it is possible to set-up a dedicated filter in order to eliminate annoying variations in the reading caused by vibrations in the machinery and display a mean value that is both stable and legible. The higher the filter setting, the more the displayed value is filtered.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to set-up the desired filter value.

Press ↵ to confirm.

**Function 37 – Position of the decimal point**

You can use this function to set-up the position of the decimal point (number of decimal places) for the material tension, setpoint and material tension alarm threshold value readings. You can only modify this setting if the current full scale value permits the reading to be displayed correctly.

Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** to select **0** for no decimal places, **0.1** for one decimal place, or **0.02** for two decimal places.

Press ↵ to confirm.

**Function 38 – Remote SETPOINT acquisition**

You can use this function to enable or disable remote acquisition of the setpoint.
Press ↵ to access the function, the display indicates the current state of this function.
Press **+** / **–** to select **OFF** if you wish to set-up the setpoint using function **F.18**, or **On** if you wish to activate remote acquisition of the setpoint.
Press ↵ to confirm.

**Function 39 – Remote SETPOINT filter**

When the setpoint value is acquired remotely (**F.38 = On**), you can use this function to set-up a suitable value for the dedicated digital filter, in order to obtain a stable signal that is free from unwanted variations. The higher the filter setting, the more the signal is filtered.
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired filter value.
Press ↵ to confirm.

**Function 40 – Remote acquisition of the DANCER ROLL AIR PRESSURE**

You can use this function to enable or disable remote acquisition of the dancer roll air pressure value.
Press ↵ to access the function, the display indicates the current state of this function.
Press **+** / **–** to select **OFF** if you wish to set-up the pressure using function **F.32**, or **On** if you wish to activate remote acquisition of the pressure value.
Press ↵ to confirm.

**Function 41 – Remote DANCER ROLL AIR PRESSURE filter**

When the dancer roll air pressure value is acquired remotely (**F.40 = On**), you can use this function to set-up a suitable value for the dedicated digital filter, in order to obtain a stable signal that is free from unwanted variations. The higher the filter setting, the more the signal is filtered.
Press ↵ to access the function, the display indicates the corresponding value.
Press **+** / **–** to set-up the desired filter value.
Press ↵ to confirm.

**Function 48 – Retain in STOP mode the last torque value used in AUTO mode**

Normally, when the machine is stationary, the torque percentage set-up in **F.1**, with the contribution of the parameters set-up in **F.16** and **F.17**, is applied to the reel; however, this means that torque applied when the machine is restarted is always the same and this can result in a marked deterioration in the regulation during restarts as the diameter decreases. To overcome this problem you can enable this function that can be used to retain the last torque value used in AUTO (which will continue to decrease as the diameter diminishes) as the machine restart torque value.
Press ↵ to access the function, the display indicates the current state of this function.
Press **+** / **–** to select **OFF** if you wish to use the parameter set-up in **F.1** as the starting torque, or **On** if you wish to retain the last value used in AUTO mode as the starting torque.
Press ↵ to confirm.

**Function 97 – Entering the "Admin"password**

In order to prevent the user from modifying the regulator settings and/or parameters, access to the functions included in the **T-two** "regulator set-up and parameters menu" is restricted to the personnel authorised when setting the unit up. Therefore, it is necessary to enter the pre-defined "Admin" password in order to access these functions (using **F.98**).
Press ↵ to access the function, the display indicates the corresponding value.

Press **+** / **–** and set-up the correct password.

Press ↵ to confirm the password.

Without accessing the set-up menu, press and hold the **+** , **–** and ↵ keys simultaneously to display the current “Admin” password.

**Function 98 – Saving the “Admin” password**

To prevent the user or unauthorised personnel from modifying the settings in the “regulator set-up and parameters menu”, you can use this function to save a new “Admin” password (consisting of a numerical value).

Press ↵ to access the function, the display indicates the current value.

Press **+** / **–** and set-up the desired password.

Press ↵ to confirm.

# Guarantees

Re S.p.A. guarantees this device against all defects relative to the materials and manufacturing for a period of 12 months from the date of delivery.
Should your device develop operating faults during the guarantee period, please contact the Company's agent in your country, or, if this is not possible, contact Re S.p.A. directly.
The guarantee includes spare parts and labour. It does not include shipment costs for device delivery or recall.
The guarantee is invalidated by:

- Improper use of the device
- Incorrect installation
- Faulty electrical connections or power supply
- Lack of maintenance
- Changes or work involving non-original components or carried out by persons without Re S.p.A. authorisation
- Complete or partial failure to observe the instructions
- Exceptional events.

At the end of the guarantee period, support will be provided by the support network, which will carry out repairs at the current rates.

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