
16.0 Warranty

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Some State jurisdictions or States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation may not apply to you. The duration of any implied warranty, including, without limitation, fitness for any particular purpose and merchantability with respect to this product, is limited to the duration of the foregoing warranty. Some states do not allow limitations on how long an implied warranty lasts but, notwithstanding, this warranty, in the absence of such limitations, shall extend for one year from the date of invoice.

ELECTROMACTIC Equipment Co., Inc.
600 Oakland Ave. Cedarhurst, NY 11516—USA
Tel: 1-800-645-4330/ Tel: 516-295-4300/ Fax: 516-295-4399

TABLE OF CONTENTS





1.0 Introduction	2
2.0 Unpacking and Contents	3
3.0 Setup	4
4.0 Charging the Battery	4
5.0 AC Operation	4
6.0 Overview of Keypad and LCD Display	5
7.0 Overview of Operating Modes	6
8.0 Changing Units of Measurement	6
9.0 General Operating Procedures	7
9.1 Additional Operating Information	
10.0 Adjusting Advanced Settings	9
10.1 Temperature Compensation	
10.2 Selecting the Baud Rate of the RS232 Interface	
10.3 Switching off the Auto-Power Off Function	
10.4 Change the Refresh Rate of the Display	
10.5 Flow Chart: Steps Required To Change Advanced Settings	
11.0 Data Transfer (Model WT-110RS only)	13
11.1 RS-232 Interface	
11.2 Analog Output	
12.0 Calibration	15
13.0 Troubleshooting Guide	17
14.0 Specifications	18
15.0 Dimensions	19
16.0 Warranty	20

1.0 INTRODUCTION

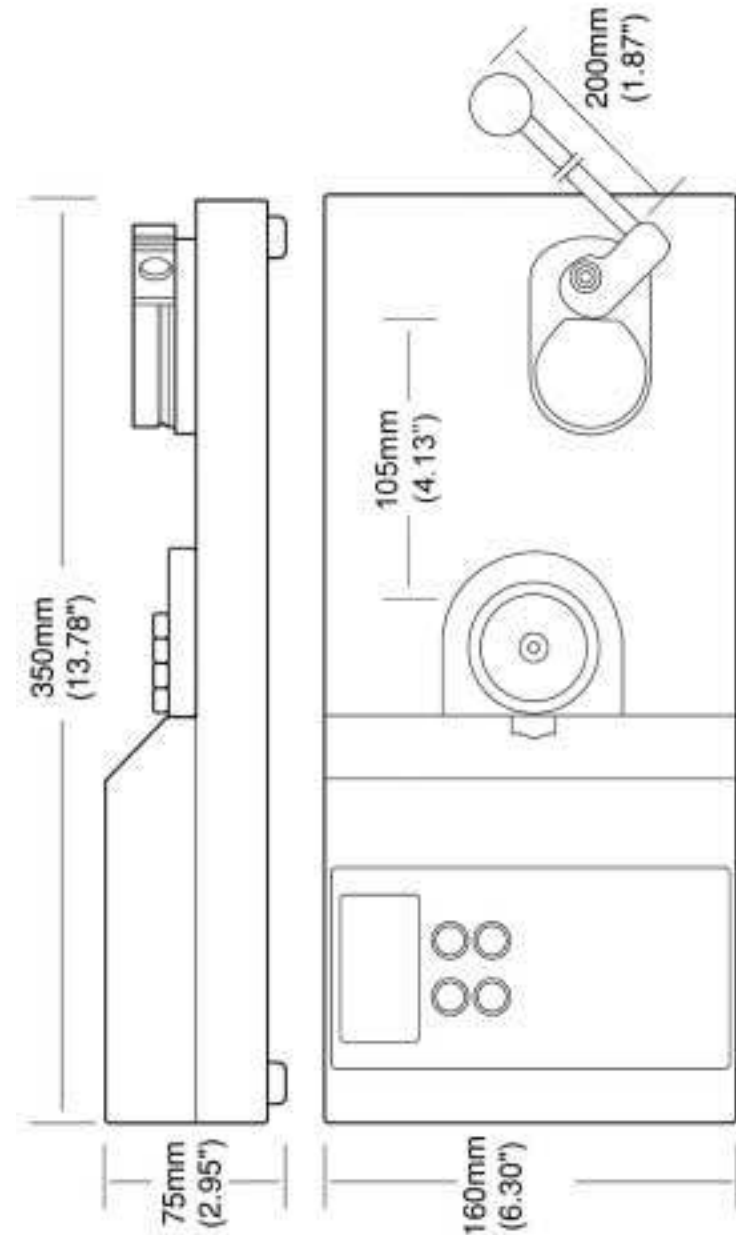
Thank you for selecting the CHECK•LINE WTT-110 Wire Terminal Pull Tester for your requirements. With correct use and proper care this product should provide many years of precise and accurate testing. Please read the entire operation manual thoroughly before using this instrument for the first time. The information contained herein will help assist users to achieve accurate and repeatable results as well as prevent damage with improper set-up or operation.

This instrument is designed for measuring tensile strength of soldered or solder-free cable joints with end sleeves, pins, solder pins or similar wire terminal components in the field of quality control or design validation.

Safety Precautions

-  **Wear appropriate eye protection at all times.**
-  The load cell can be damaged if the internal measuring system is overloaded. Do not exceed the maximum measuring limit of 50 Kg (110 lbs. or 500N).
-  Transport and store the instrument with great care. This reduces the risk of damage to the load cell or other minor mechanical problems which can result in inaccurate measurement results.
-  Operate the instrument in appropriate environments only. The instrument is equipped with a temperature compensation for a temperature range of 32 to 120 °F (0° to 40°C) and should be used in this temperature range only. Do not expose this device to liquid or operate in high-humidity environments.

15.0 Dimensions



14.0 SPECIFICATIONS

Measuring Range*	0–50 Kg / 0–110 lbs / 0–500N (units selected via keypad)
Resolution	0.01Kg / 0.1 lbs / 0.1 N
Terminal adapter slot width (mm)	0.5, 0.8, 1.0, 1.4, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 5.0, 6.0
Accuracy	±0.5% F.S. or better
Operating Mode	Continuous Displays actual value in Kg, lbs. or N Peak-Hold Displays peak value in Kg, lbs. or N
Wire Diameter	SAE AS7928 II AWG 8. . .30 IEC 60352-2 Cross section 0.05. . .10mm ² Maximum 0.236" (6mm)
Overload	200% Full Scale (LCD indicator at 120%)
Display	LCD, 4–1/2 digit, 12mm high
Memory	Peak Value
Power Supply	Internal NiCd battery, supplied with AC adapter/charger (100-240V/50-60 Hz)
Temp. Range	Operating 32 to 104 °F (0 to 40 °C) Storage –4 to 140 °F (–20 to 60 °C)
Weight, approx.	30.8 lbs. (14 Kg)
Dimensions	14.2" x 6.3" x 2.95" (360 x 160 x 75mm)
Material	Anodized aluminum, steel and stainless steel

* Low-range model available on special order basis.

Model WTT-110RS Only

Interface

Serial	2400 KB / 8 / N / 1 / None (selectable baud rate)
Analog	0-1VDC

2.0 UNPACKING & CONTENTS

Remove the unit carefully and check the unit appears undamaged in shipment. Check to see that all of the supplied items are contained in the box (see below). Retain packaging materials in the case that the unit needs to be returned to the manufacturer or distributor.

- Main instrument table
- Separate hand lever with ball end
- 9V DC battery charger 100 to 240 VDC (50 to 60Hz) with Euro/US/UK plug adaptor
- Operating instruction manual
- Connection cable for RS232C (WTT-110RS model ONLY), not shown



3.0 SETUP

Place the WTT-110 Wire Terminal Tester on a level and stable work area where the user can perform the testing in a comfortable manner. The surface should be clean and grease-free, so that the instrument does not slip.

Make sure that there is no residue from the packaging materials stuck under and around any of the operating components especially in the recessed area around the rotating terminal fixture (see photo) and under the lever arm base plate, etc. Use of compressed air to clear any debris from these areas is recommended.



Please note that the instrument weighs approximately 30 pounds (14 kg), so please use necessary precautions when lifting and moving. We suggest that the location is in close proximity to an AC-Power outlet.

Locate the lever and screw it in to the threaded hole in the rotating wire clamp fixture, as shown in the photo. Turn the lever in a clockwise direction to screw-in. Continue until it is "hand-tight." DO NOT OVERTIGHTEN.



4.0 CHARGING THE BATTERY (REQUIRED BEFORE FIRST USE)

For safety reasons, the WTT-110 is supplied with the batteries fully discharged. To obtain maximum battery life we recommend that you charge the internal NiCd battery for approximately 18 hours before first using this instrument the first time.

Select the appropriate plug adapter for the outlet type and country of use. Plug the charger into an AC-outlet and plug the other end into the receptacle on the left side of the WTT-110. Charge the batteries.

Note: The BAT indicator is shown on the display when the batteries are being charged and turns off when the batteries are fully charged. When the batteries are nearly discharged, the "LO BAT" indicator will blink on and off.

5.0 AC-OPERATION

The WTT-110 can be operated using the AC-Adapter/Charger. The batteries are being recharged while plugged into the AC power source. Total battery recharge time will be significantly longer than if recharged while turned off.

13.0 TROUBLESHOOTING GUIDE

If any error codes are shown on the display, first try turning the power off and then back on again. If the code is still on the display, refer to the chart below.

Small Display	Condition	Action
OVM OVP	Minus side overload condition Plus side overload condition	Remove excessive load. If the display does not return to normal operation, send unit in for repair
OV+ OV-	The load exceeds 120% of its capacity	Remove excessive load
ERR - 3 - ERR - 4 -	EEPROM reading error EEPROM writing error	Turn the unit off, then turn on again. If the display does not return to normal operation, send the unit in for repair

Industry-Based Standards, Specifications and Recommendations

AWG	Cross-Section	Cable Diameter	SAE AS7928	IEC 60352 Part 2	UL 486 C
30	0,06 mm ₂	0,36 mm		6 N	6 N
28	0,09 mm ₂	0,38 mm		11 N	11 N
26	0,14 mm ₂	0,48 mm	32 N	18 N	18 N
24	0,22 mm ₂	0,61 mm	45 N	28 N	28 N
22	0,34 mm ₂	0,76 mm	67 N	40 N	40 N
20	0,56 mm ₂	0,97 mm	85 N	60 N	45 N
18	0,93 mm ₂	1,27 mm	170 N	90 N	45 N
16	1,25 mm ₂	1,44 mm	223 N	135 N	68 N
14	1,93 mm ₂	1,80 mm	312 N	200 N	100 N
12	3,16 mm ₂	2,29 mm	490 N	275 N	138 N
10	4,65 mm ₂	3,10 mm		355 N	

DIN 41611/3 is replaced by DIN IEC 60352 Part 2
BS5B178 corresponds to IEC 60352 Part 2
MIL-T-7928 is replaced by SAE AS7928 Table II
UL486A corresponds to IEC 60352 Part 2

Pull Test Specifications for UL, MIL and SAE

Size of Conductor		UL 486A Table 12.1		SAE AS7928 Table II	
AWG	(mm ²)	Pounds	(N)	Pounds	(N)
30	0.050	1-1.5	6.7	N/A	N/A
28	0.080	2	8.9	N/A	N/A
26	0.130	3	13.4	7	3.12
24	0.200	5	22.3	10	44.5
22	0.324	8	35.6	15	66.8
20	0.519	13	57.9	19	84.6
18	0.823	20	89.0	38	169.1
16	1.310	30	133.5	50	222.5
14	2.080	50	222.5	70	311.5
12	3.310	70	311.5	110	489.5
10	5.261	80	356.0	N/A	N/A

Re-Calibration Procedures

1. Turn POWER off. Make sure the weight is NOT suspended from the sample.
2. Press and hold the UNIT, PEAK and ZERO keys simultaneously.
3. Press and release the On/Off key (while continuing to press UNIT, PEAK and ZERO) until the smaller characters at the top of the display show CAL.
4. Release the UNITS, PEAK and ZERO keys.

CAL
-00-

5. The force gauge is now in calibration mode.
6. Press the UNITS switch. The display will show ZER after blinking SCN for 10 seconds.

"SCN"
-00- → ZER
88888

7. The force gauge is now ready for zero point calibration.
8. Press ZERO key to confirm the zero calibration. Wait approximately 15–20 seconds. The display will change to show PEK after blinking SCN. Do not press any other keys or disturb the instrument or weight during calibration.

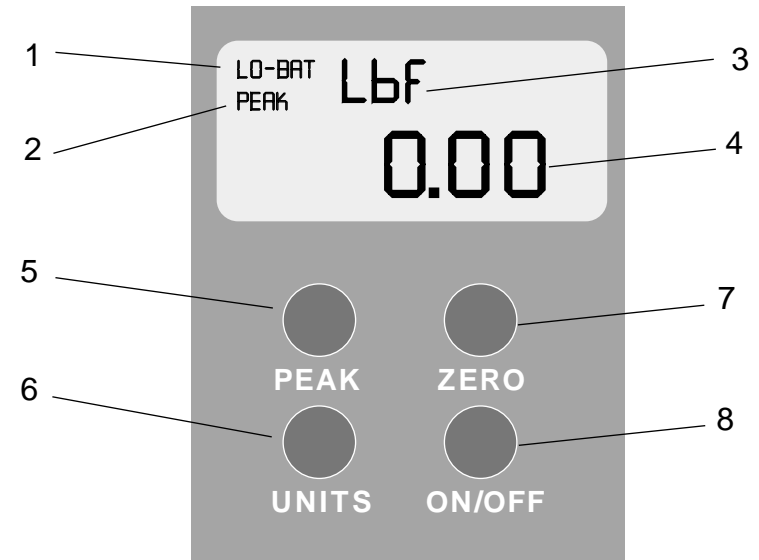
"SCN"
88888 → PEK
88888

9. Hang the 50 Kg calibration weight from the sample which is hooked on to one of the teeth of the Wire Terminal Fixture. Make sure that the material path is unobstructed and in a straight horizontal orientation. The force gauge is now ready for full-scale calibration.
10. Press the PEAK key to begin full scale calibration. The display will blink SCN. Do not press any other keys or touch the weight during calibration. After approximately 15–20 seconds the display will blink END. Then after approximately 5 seconds the display blinks OK.

"SCN"
88888 → "End"
88888 → "oK"
88888

11. If calibration was successful, the display will show OK momentarily (see above illustration). Press the UNITS key, then the power will automatically switch off.
12. If calibration was unsuccessful, the display will show ERR. Remove the calibration weight, then press the UNIT key and repeat the above procedure again.

6.0 OVERVIEW OF KEYPAD & LCD DISPLAY



- 1 **Low Battery Indicator.** Flashes when batteries need charging, turns off when fully charged. Remains on while charging.
- 2 **Peak Mode Indicator.** Shown on display when configured for peak mode (stores highest peak force until it is reset by pressing zero key)
- 3 **Units Indicator.** Displays currently selected units of measure (pounds, newtons or kilograms). Changed by pressing UNITS key.
- 4 **Force Value.** Displays current or peak force value in user-selected units of measure.
- 5 **PEAK Key.** Turns on Peak Force Capture Mode. When selected, the highest peak value will be shown on the display until reset by ZERO key.
- 6 **UNITS Key.** Selects desired units of measure. Each time this key is pressed, the units will change from one to the next.
- 7 **ZERO Key.** Performs a “tare” on the system and resets display to zero. When in peak mode, it erases the previously stored peak value.
- 8 **ON/OFF Key.** Turns the system on and off.

7.0 OVERVIEW OF OPERATING MODES

The WTT-110 can be set to operate in one of two distinct operating modes: Peak Capture or Average. In **Peak Capture Mode**, the system measures the force at a frequency of 1000 Hz (1000 times per second) and displays the highest force measurement. The peak value remains on the display until a higher force value is measured or until the user presses the ZERO key.

In **Average Measurement Mode**, the system measures the force at a frequency of 1000 Hz (1000 times per second) and displays the average each time the display is updated. The factory default display update rate is 3 times per second (1 time every 1/3 second).

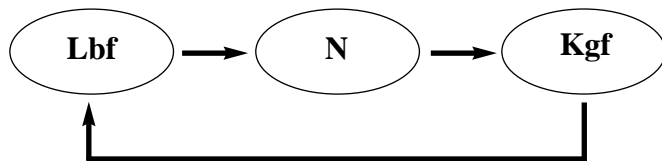
Note: Refer to Advanced Setting, section 10, page 10, for additional information and to change the update rate.

8.0 CHANGING UNITS OF MEASUREMENT

The WTT-110 can display force measurements in any of the following three engineering units:

- lbf (pounds)
- N (Newtons)
- Kgf (kilograms)

To change the selected engineering units for display press UNITS key. Each time the key is pressed, the units will change from one to the other as follows:



12.0 CALIBRATION

The WTT-110 Pull Tester has been calibrated in accordance with factory procedures and is certified to perform within the stated accuracy specifications shown in the Specifications section found on page 18. Assuming the unit is handled with care and operated as detailed in this manual it should remain accurate for an extended time period. If however, it is subjected to forces that exceed its maximum range or if it is not properly cared for, it might need to be recalibrated.

It is recommended that the calibration is verified at least on an annual basis and more frequently if feasible. Normally, instruments of this type go out of tolerance from one day to the next and rarely on a regular periodic basis.

A calibration procedure is provided in this manual, however it should only be performed by individuals properly trained for this type of service and with the appropriate certified standards (known weights or secondary force measuring system such as a load cell, etc.).

Re-Calibration Set-up

1. Remove the lever by unscrewing it in a counter-clockwise direction and move the Wire Clamp assembly out from the path of the hanging sample.
2. Position the WTT-110 in a vertical position so that the keypad & display are at the top (refer to photo). Be sure to secure it so it can not topple over when the weight is attached.
3. Using a heavy-duty monofilament (fishing line), wire or similar, suspend a 50 Kg weight from one of the teeth on the wire terminal fixture by hooking a loop of the material over the selected tooth.
4. Temporarily, remove the weight and follow the Re-Calibration Procedures shown on page 16.



- Make sure that the WTT-110 is well secured in the vertical position.

Caution

- Select a material that is strong enough to support 50 Kg of weight.



PROTOCOL CODE		
Extern >>	Average data output 3. digit: + /or - 4.-6. digit. Value incl. floating decimal point	NA@@@@@cr
	Peak data output 3. digit: + /or - 4.-6. digit. Value incl. floating decimal point	NB@@@@@cr
	Unit: 3 digit 0 = N 1 = kg (g) 3= lb (oz)	NH@cr
	Unit: 3 digit 0 = N 1 = kg (g) 3= lb (oz)	NH@cr
Error	OBcr	Command Error
	OEcr	Parity Error
	OFcr	Format Error
	OGcr	Summing Error
	OHcr	Overflow

11.2 Analog Output

The analog output (-1...0...1 VDC) can be used for any data acquisition or data recording device. Pull Force data will be expressed as a negative voltage. The signal can be set to zero (reset) by performing a ZERO (tare) function. +1 VDC and - 1VDC refers to the maximum and minimum full scale (end of nominal measuring range).

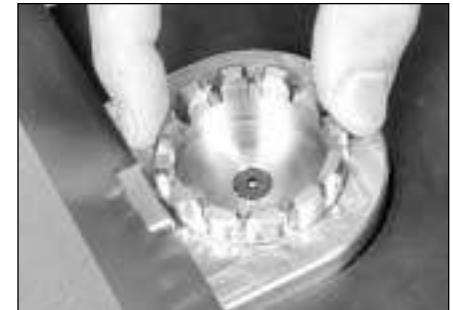
SPECIFICATION	
Amplitude	-1VDC / +1VDC
Signal generator	12-bit D/A-Converter
Signal update	100 Hz

9.0 GENERAL OPERATING PROCEDURES

1. Press On/Off key. During power-up, the WTT-110 performs a self-test routine. During this procedure, the maximum capacity of the system will be temporarily displayed in selected units of measurement. Then the unit should display zero. Occasionally the last one or two digits might be something other than zero. Additionally, the selected units will be shown.
2. Select the desired operation mode. To set for **Peak Capture Mode**, press the PEAK key once. The peak indicator will be shown on the display when the system is set for peak capture mode (highest value measured and stored until reset to zero). To set for **Average Mode**, make sure the peak indicator is not shown. Press the PEAK key until indicator is no longer illuminated. In this mode, the display is constantly updated 3 times per second.

Note: The Display Update Rate can be set to update 1, 2, 3, 5, 10 or 20 times per second (5 times per second = 0.2 seconds). Refer to Advanced Setting, section 10.4, page 11 for additional information and to change the update rate.

3. It is necessary to zero-set ("tare") the WTT-110 before starting each force measurement. Press the ZERO key for this purpose. The ZERO key is also used for clearing the currently stored Peak value from display memory whenever desired.
4. Select the smallest suitable slot in the Wire Terminal Fixture based on the diameter of the wire and the physical dimensions of the connector. Rotate the fixture so the selected slot is in the 3 o'clock position so it is closest to the Wire Clamp Fixture.



5. Place the cable connection into the fixture such that the main part of the connector is retained on the inside of the fixture and the sleeve and cable will pass through the slot toward the Wire Clamp Fixture. When pulling on the cable, the terminal should be well secured.



6. Insert the free end of the cable using a small amount of tension into the Wire Clamp Fixture and rotate the handle clockwise until the cable is clamped between the two metal surfaces.



You are now ready to begin the pull test.

7. Continue to rotate the lever clockwise. The pull force on the terminal connection will continue to increase as the lever is rotated.



DO NOT EXCEED THE MAXIMUM CAPACITY OF THIS UNIT (110 lbs/50 Kg/500N) OR DAMAGE COULD RESULT.

8. Eventually, the cable will pull out from the terminal connection. The test is now complete. If set for Peak Capture Mode (refer to Overview of Operating Modes, page 6), the peak force value will be stored in the display memory. If set for Average Mode, the display would have been updated throughout the test cycle.



9. To perform another test, repeat the steps detailed above. If operating in Peak Capture Mode, be sure to press the ZERO key to delete the previously stored peak value.

11.0 DATA TRANSFER (MODEL WTT-110RS ONLY)

Model WTT-110RS testers can transfer measuring data by means of an RS-232C interface. A 9-pin D-Sub connector is provided for this purpose, which can be found at the left side of the instrument. A connector cable for the serial port is included. If a custom serial cable must be used or if the user wishes to access the analog output, the pin designations are as follows:



Pin	Description
1	Analog signal +
2	Serial : TXD
3	Serial : RXD
5	Serial : GND
9	Analog: Signal Gnd

11.1 RS-232C Interface

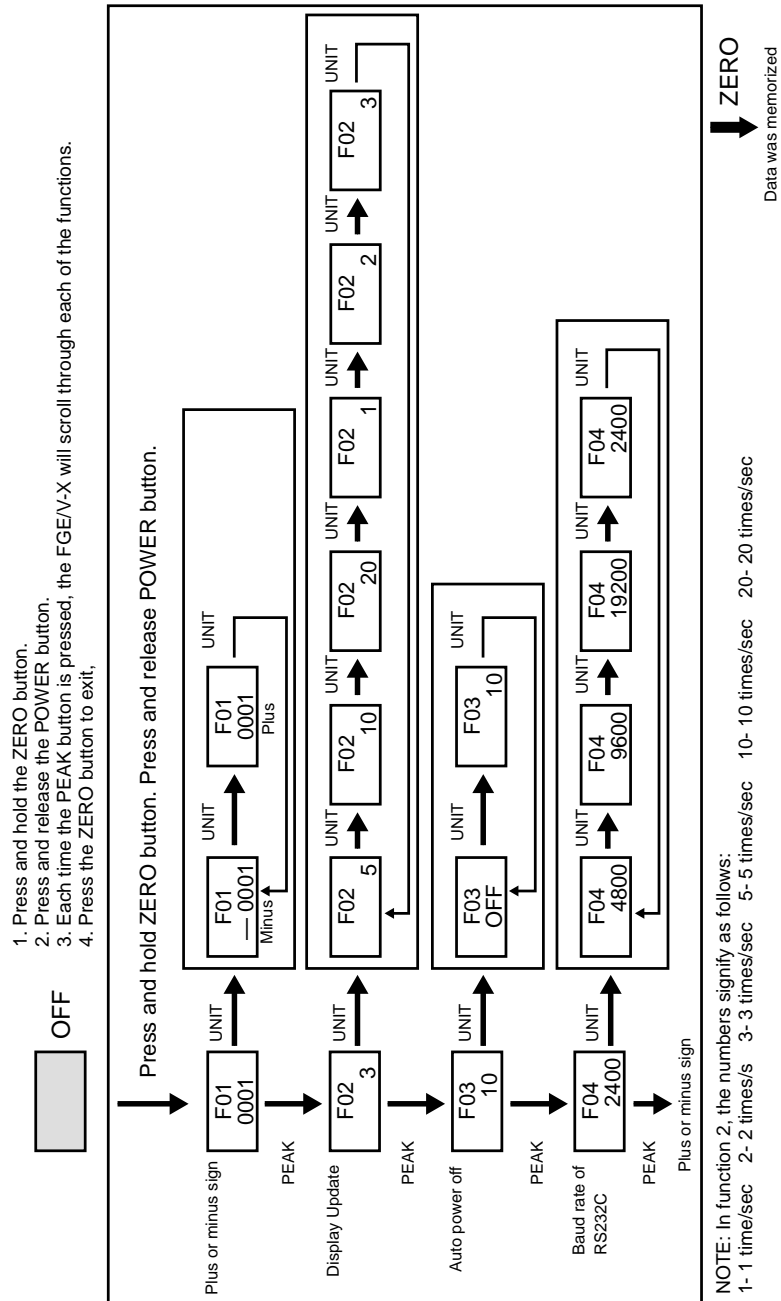
The RS-232C interface can be used for the direct communication between an appropriate serial I/O-card of a computer and the instrument. The minimum requirement for the data transfer up to 19200 baud is the connection of the RXD, TXD and GND communication terminal.

SPECIFICATION	
Baud rate	2400, 4800; 9600 or 19200 (selectable, see general settings)
Data length	8 bits
Stop bit	1
Parity	None

PROTOCOL CODE		
Extern >>	AAcr	Tare
	ABcr	Stop Output
	ACcr	Change to Peak Mode
	ADcr	Change to Average Mode
	AEcr	Reset Peak
	AFcr	Change Units to kg (g)
	AGcr	Change Units to N
	AHcr	Change Units to lb (oz)
	BAcr	Data output request (single reading)
	BBcr	Data output request (10/sec)
	BB1cr	Data output request (20/sec)
	BB2cr	Data output request (50/sec)
	BB3cr	Data output request (100/sec)
	BDcr	Units confirmation request
	BEcr	Peak data output request
	BFcr	Minus peak data output request
	cr	(carriage return)

Chart continues on next page

10.5 Flow Chart Illustrating the Steps Required To Change Advanced Settings



9.10 Additional Operating Information

Low Battery

When battery charge is low, the LO BAT indicator will blink on and off in the LCD Display indicating that the batteries need to be charged. Charging time of fully depleted batteries is approximately 18 hours when the unit is off. The adapter/charger automatically shuts off when the battery is at full charge to protect the battery. The adapter/charger can be used to power the unit during battery charging, but this will lengthen the charging time. Refer to Charging the Battery, section 4, page 4, for additional information.

Auto Power Off

If the gauge is on and there is no activity for 10 minutes, the unit will automatically power off to conserve battery charge. PWR appears above the display digits to notify that there is 1 minute before power off. If the adapter/charger is powering the gauge, auto power off function becomes inactive.

Temperature Compensation

The WTT-110 utilizes a built-in temperature compensation system to provide optimum accuracy and to prevent signal drift. If the user would like to disable this feature, please refer to the Advanced Settings section on page 10.

10.0 ADJUSTING ADVANCED SETTINGS

There are several adjustable settings that can be changed from the factory defaults to customize the WTT-110 to meet the exact requirements of the user. These settings are saved in the microprocessor and are recalled each time the system is powered up.

10.1 Temperature Compensation (Default: SET=on)

In general, it is recommended to have the this function turned on as long as it does not effect your measuring results. Only when measuring very minute forces over a longer period of time at a slow rate and under stable environmental conditions might it be useful to switch this off.

- Switch off the instrument.
- Press and hold PEAK- and MODE-buttons.
- Press ON/OFF-button.
- Wait until TRK oFF is displayed.
- Release PEAK- and MODE-buttons.



10.2 Selecting the baud rate of the RS232C interface (Default: 2400)

On the WT-110RS model ONLY, the speed of the data transfer for the RS232C interface can be adjusted as follows:

- Switch off the instrument.
- Press and hold RESET-button.
- Press ON/OFF-button.
- Wait until f01 is displayed, then release RESET-button.
- Select function f04 by repeating to press the PEAK-button until f04 is shown on the display.
- Select appropriate baud rate (2400/4800/9600/19200) by repeating to press the MODE-button.
- Press RESET-button to save your settings.

10.3 Switching off Auto Power-Off function (Default: 10 min)

While operating under battery power the instrument will be automatically switched off after approx. 10 minutes on inactivity. This Auto Power-Off function can be deactivated, which may become necessary when monitoring the fluctuation of applied forces for a longer period of time. This function is disabled when the instrument is powered by the AC-adaptor.

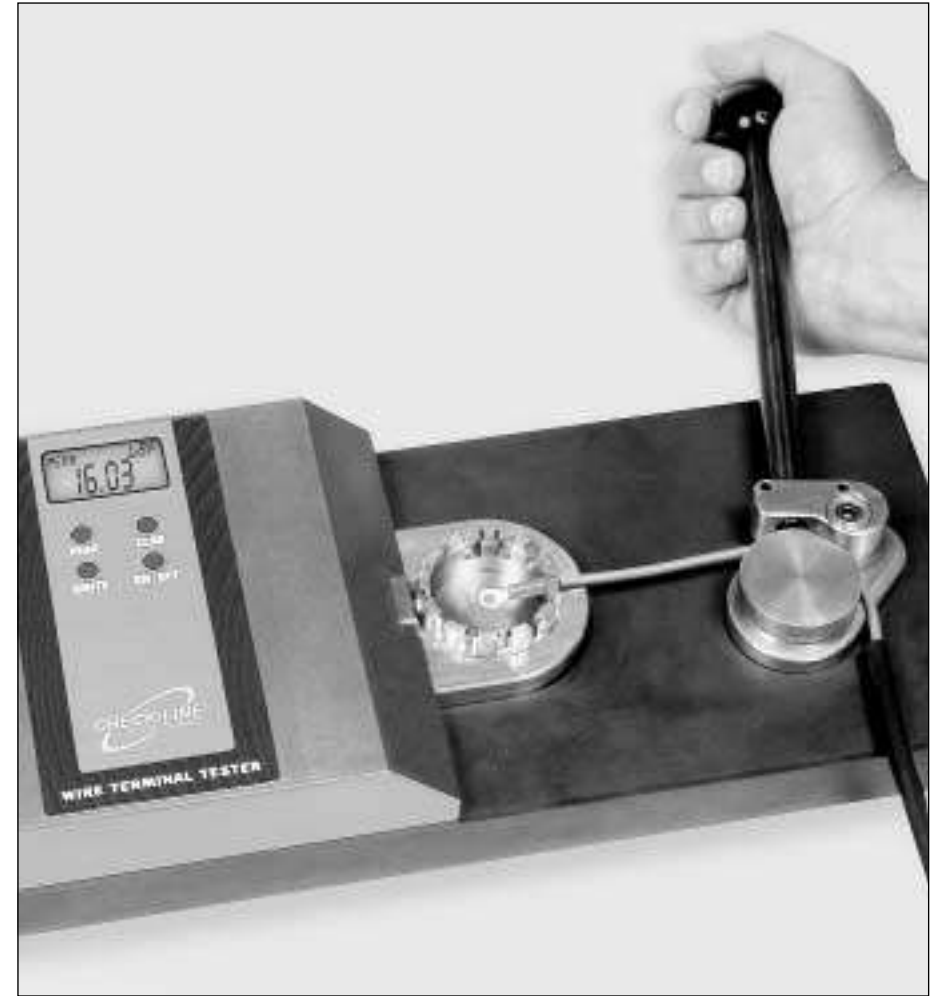
- Switch off the instrument.
- Press and hold RESET-button.
- Press ON/OFF-button.
- Wait until f01 is displayed, then release RESET-button.
- Select function f03 by repeating to press the PEAK-button until f03 is shown on the display.
- Select setting (10/OFF) by repeating to press the MODE-button.
- Press RESET-button to save your settings.

10.4 Change the refresh rate of the display (Default: 3/sec)

The force applied to the load cell of the instrument is internally processed at a rate of 1000 Hz, which allows the precise capturing of the peak values. The readings on the display, however, are refreshed 3 times/sec only for the convenience of the human eyes. You may increase or decrease the factory settings for them to match your personal demands.

- Switch off the instrument.
- Press and hold RESET-button.
- Press ON/OFF-button.
- Wait until f01 is displayed, then release RESET-button.
- Select function f02 by repeating to press the PEAK-button until f02 is shown on the display.
- Select refresh-time (1/2/3/5/10/20 times/sec) by repeating to press the MODE-button.
- Press RESET-button to save your settings.

WTT-110 & WTT-110RS WIRE TERMINAL PULL TESTER



ELECTROMATIC
EQUIPMENT CO., INC.
600 Oakland Ave., Cedarhurst, NY 11516-U.S.A.
TEL: 516-295-4300 • FAX: 516-295-4399

Operating Instructions