VT400
Weight Indicator
Technical Manual

Revision A2, November 2005

Doc # UM-VT400-EN

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Legal Notice

Warranty

Vishay Transducers warrants all instruments it manufactures to be free from defect in materials and factory workmanship, and agrees to repair or replace any instrument that fails to perform as specified within one year after date of shipment. Coverage of computers, cameras, rechargeable batteries, and similar items, sold in conjunction with equipment manufactured by Vishay Transducers and bearing the identifying name of another company, is limited under this warranty to one year after the date of shipment. The warranty on non-rechargeable batteries and similar consumable items is limited to the delivery of goods free from defects in materials and factory workmanship.

This warranty shall not apply to any instrument that has been repaired, worked on or altered by persons unauthorized by Vishay Transducers in such a manner as to injure, in our sole judgment, the performance, stability, or reliability of the instrument; subjected to misuse, negligence or accident; or connected, installed, adjusted, or used otherwise than in accordance with the instructions furnished by us.

At no charge, we will repair, at our plant, or at an authorized repair station, or at our option, replace any of our products found to be defective under this Warranty.

This Warranty is in lieu of any other warranties, expressed or implied, including any implied warranties of merchantability or fitness for a particular purpose. There are no warranties which extend beyond the description on the face hereof, Purchaser acknowledges that no salesman, agent, employee or other person has made any such presentations or warranties or otherwise assumed for Vishay Transducers any liability in connection with the sale of any goods to the purchase. Buyer hereby waives all rights Buyer may have arising out of any breach of contract or breach of warranty on the part of Vishay Transducers, to any incidental or consequential damages, including but not limited to damages to property, damages for injury to the person, damages for loss of use, loss of time, loss of profits or income, or loss resulting from personal injury.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, so the above limitations or exclusions may not apply to you.

The Purchaser agrees that the Purchaser is responsible for notifying any subsequent Buyer of goods manufactured by Vishay Transducers of the warranty provisions, limitations, exclusions and disclaimers stated herein, prior to the time any such goods are purchased by such Buyer, and the Purchaser hereby agrees to indemnify and hold Vishay Transducers harmless from any claim asserted against or liability imposed on Vishay Transducers occasioned by the failure of the Purchaser to so notify such Buyer. This provision is not intended to afford subsequent Purchasers any warranties or rights not expressly granted to such subsequent Purchasers under the law.

Vishay Transducers reserves the right to make any changes in the design or construction of its instruments at any time, without incurring any obligation to make any change whatever in units previously delivered. Vishay Transducers' sole liabilities, and Buyer's sole remedies, under this agreement shall be limited to the purchase price, or at our sole discretion, to the repair or replacement of any instrument that proves, upon examination, to be defective, when returned to our factory, transportation prepaid by the Buyer, within the applicable period of time from the date of original shipment. Return transportation charges of repaired or replacement instruments under warranty will be prepaid by Vishay Transducers.

Vishay Transducers is solely a manufacturer and assumes no responsibility of any form for the accuracy or adequacy of any test results, data, or conclusions which may result from the use of its equipment.

The manner in which the equipment is employed and the use to which the data and test results may be put are completely in the hands of the Purchaser. Vishay Transducers shall in no way be liable for damages consequential or incidental to defects in any of its products.

This warranty constitutes the full understanding between the Manufacturer and Buyer, and no terms, conditions, understanding or agreement purporting to modify or vary the terms hereof shall be binding unless hereafter made in writing and signed by an authorized official of Vishay Transducers.

Safety Instructions

The following instructions serve as a general guide for the safe operation of the VT400.

Safety Symbols

This symbol indicates potential safety hazards regarding product operation or maintenance to operator or service personnel.

General Safety Practices

Do not touch or tamper with the power supply when the power cord is connected. Line voltages may be present even when the product is powered off or a fuse is blown.

Before working on equipment connected to power lines or to other devices, remove jewelry or any other metallic object that may come into contact with energized parts.

The product is intended to be grounded during normal use. Grounding is provided by connecting the mains plug to a wall socket with a protective earth terminal. The earth lug provided on the product should be connected to the protective earth at all times, by a wire with a diameter of 18 AWG or wider.

Always make the ground connection first and disconnect it last. Do not connect data cables to ungrounded equipment. Make sure that all other cables are disconnected before disconnecting the ground.

Special Safety Warnings

Welding on or in the vicinity of the equipment is strictly prohibited.

Use reliable lightening conductors to prevent static loads caused by thunderstorms.

Connection of AC Mains

Make sure that the electrical installation complies with local codes. Always connect the AC plug to a wall socket with a protective ground.

The maximum permissible current capability of the branch distribution circuit that supplies power to the product is 16A. The circuit breaker in the building installation should have high breaking capacity and must operate at short-circuit current exceeding 35A.

Always connect the power cord first to the equipment and then to the wall socket. If the power cord cannot be readily disconnected in case of emergency, make sure that a readily accessible circuit breaker or emergency switch is installed in the building.

Operating Environment

Ambient Temperature	Storage temperature: -10C to +70C (14F to 158F). Operating temperature: -10C to +40C (14F to 104F).
Humidity	40% to 90% RH (non condensing).
Vibration	Severe vibration can affect the accuracy of weighing and damage components.
Air	The air surrounding the product should be dust-free and should not contain corrosive gasses or other materials that could adversely effect the product.
Electromagnetic Fields	Heavy electrical equipment should not be installed near to the weighing apparatus.
Incoming and Outgoing Signals	Relays and contacts connected to the equipment must have reliable and effective interference suppression. This also applies to other equipment within 3 meters of the equipment.

Declaration of Conformity

Non-Automatic Weighing Instrument (III)

Manufacturer	Vishay Transducers
Type/Model	VT400
EC Type Approval Certificate Number	DK 0199.62

Corresponds to the production model described in the EC Type Approval Certificate and to the requirements of the Council Directive 90/384/EEC as amended and to the requirements of the following EC Directives:

EN 45501:1994, The Metrological Aspects of Non-Automatic Weighing Machines.

EN 55022:1987, Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.

EN 60950:1992, Safety of Information Technology Equipment.

Date	April 30, 2004
Signature	Benny Shaya, Director R&D/Operations Instruments Being the responsible person employed and appointed by Vishay Transducers.

About this Document

This document explains how to use and service the VT400 Weight Indicator. It is intended for technical staff tasked with installing, setting up, configuring and monitoring the indicator, as well as troubleshooting and servicing it.

Chapters and Their Contents

Style Conventions

Verdana	Regular text.
Arial Bold	Keys, menus, commands and parameters.
Monospace	Text displayed on the LCD, text a user must key in, or values of parameters.
	**Notes,** which offer an additional explanation or a hint on how to overcome a common problem.
	**Warnings**, which indicate potential safety hazards regarding product operation or maintenance to operator or service personnel.

1 Technical Specifications

1.1 General

CPU characteristics	MCU 89C51RD, 64KB Flash ROM, 1KB RAM, 32KB serial EEPROM.
Communication	• Serial port 1: RS232C Full duplex, 2400 baud, 7 data bits/even parity or 8 data bits/no parity. • Serial port 2: (optional): RS485 half duplex, 2400-57600 baud, no or even parity, 7 or 8 data bits.
Display	6 digit red LED (20mm height) display.
Annunciators	Net, no motion, tare, weight range 1 and 2.
Keyboard	6-key membrane type with tactile feedback.
Approvals	EU type approval 10,000 divisions, 0199.62.
Accuracy class	III.
Resolution	Selectable up to 99.000dd (in accordance with regulations).
Max tare effect	Full scale (100%).
Auto zero track	Off or 0.5dd setup, selectable.
Weight digits	4, 5 or 6.
Weight steps	1, 2, 5, 10, 20, 50, 100, 200.
Digital filter	FIR automatically adjusted to conversion speed, plus post filtering (rolling average of 1, 2, 4, 8, 16, 32 samples).
Calibration methods	Dead load, span and scale parameters via keyboard commands. Calibration can be performed either by weighing or by entering load cell mV values.
Self diagnostics	Hardware and software, MCU watchdog, memory failure, I/O failure, program check.

1.2 Analog Input

Load cell excitation	±5V switched polarity or +5VDC with sense.
Connection	6-wire technique. Max 10 load cells 350Ohm each.
Signal range	• -0.25 to 1.75mV/V (Gain=10). • -0.25 to 3.75mV/V (Gain=20).
Sensitivity	• Approved scales: min 0.4µV / digit (VSI). • Non-approved scaled: min 0.1µV / digit.
Input amplifier	Input noise 0.3µVp-p, input bias current 10nA typical.
A/D Converter	Sigma delta 550.000 internal counts max. Conversion speed: 3, 7, 14, 28, 57, 70Hz (selectable).
Linearity	Within 0.002% of full scale.
Span temp coefficient	≤2ppm/°C.
Zero temp coefficient	≤2ppm/°C.
Long-term stability	0.005% of full scale per year.

1.3 Analog Output (Optional)

Current or voltage	Selected via jumper JP1 on printed circuit board 761 (see section 7.4).
Current output	0-20mA or 4-20mA. Max load resistance 1KΩ (line + termination).
Voltage output	0.02-10V. Min load resistance 1KΩ (This is the default output).
Resolution	• Internal: 16 bits. • External: 16 bits, or in accordance with regulation.
Linearity	Better than 0.01% of FSR.
Thermal stability	50ppm/°C typical.
Short-circuit protection	25mA indefinite duration.

1.4 Digital Input

Input voltage	9-24VDC, positive common, optoisolated to 2.5KV.
Input resistance	3.3KΩ.
On delay	2msec max.
Off delay	2msec max.

1.5 Digital Outputs

Output voltage	24 VDC ±10% transistor (source) darlington, positive common.
Max current	100mA, leakage current 100µA.
Max off-state voltage	30VDC.
On delay	2msec max.
Off delay	2msec.

Both outputs are optoisolated to 2.5KV.

2 Installation

2.1 Site Requirements

The mounting location must be a stable surface, free of vibrations, heat or humidity. Avoid direct sunlight on the front of the instrument. The unit should be placed at the correct height to allow easy reading of the display and convenient keyboard operation.

2.2 Mounting the Indicator

2.2.1 Installation

The indicator is panel-mounted. The cut-out dimensions for panel installation are 136.5mm x 66.5mm. The front and rear views of the unit are shown in Figure 1.

Figure 1 – Front and rear views of the VT400

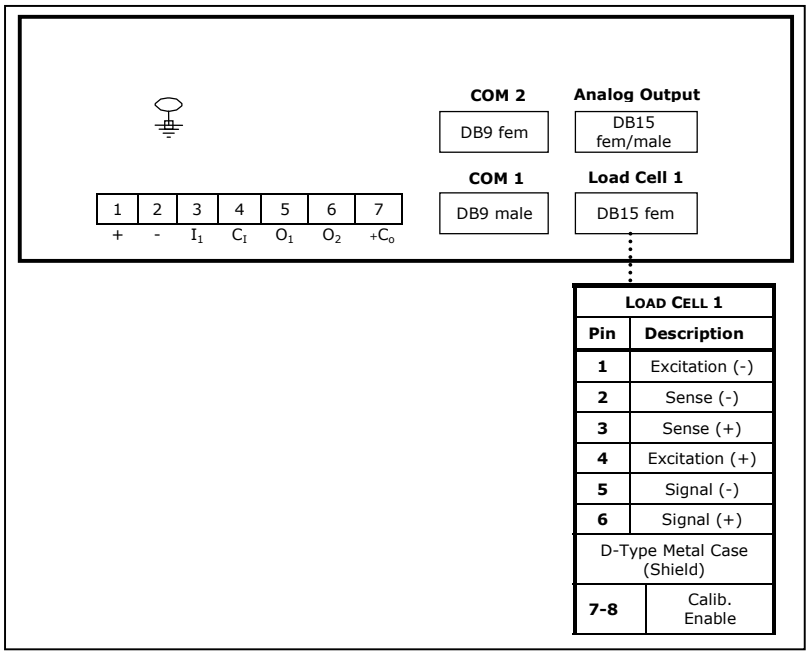
2.2.2 Wiring

All connections to the instrument are made through the rear panel connectors. Strain-relief clamps should be used. The shield should be connected to the metal frame of the connector.

Do not run signal cables together with power cables. Connect the shielding only where indicated in the drawing. Never use a Megger to check wiring. Never use plastic insulating tape on load cell connections.

2.3 Connecting Load Cells

Use 6 x 0.5mm^2 shielded cable for load cell connections. Maximum length 300m. Connect the load cells according to the diagram below.



LOAD CELL 1	
Pin	**Description**
1	Excitation (-)
2	Sense (-)
3	Sense (+)
4	Excitation (+)
5	Signal (-)
6	Signal (+)
D-Type Metal Case (Shield)	
7-8	Calib. Enable

Figure 2 – Load cell connection diagram

2.3.1 Load Cell Operating Parameters

The load cell utilization ranges are listed in the table below.

Excitation	5VDC, fixed or alternating polarity (setup-selectable) for 10 load cells of 350Ω each.
Gain / input ranges	• For load cell output of 10mV, gain permitted is between -0.25 and 1.75mV/V. • For load cell output of 20mV, gain permitted is between -0.25 and 3.75mV/V. The load cells must be chosen so that the input signal to the controller is at least 0.4µV per scale increment. For load cell output less than 0.4µV/digit, the controller will still be stable but the full temperature range accuracy is not guaranteed.

2.4 Serial Connections

- For RS232C connection, use 3 x 0.34mm^2 shielded cable.
- For RS485 connection, use 2 x 0.34mm^2 shielded twisted pair cable.

2.4.1 Printer and PC Cables

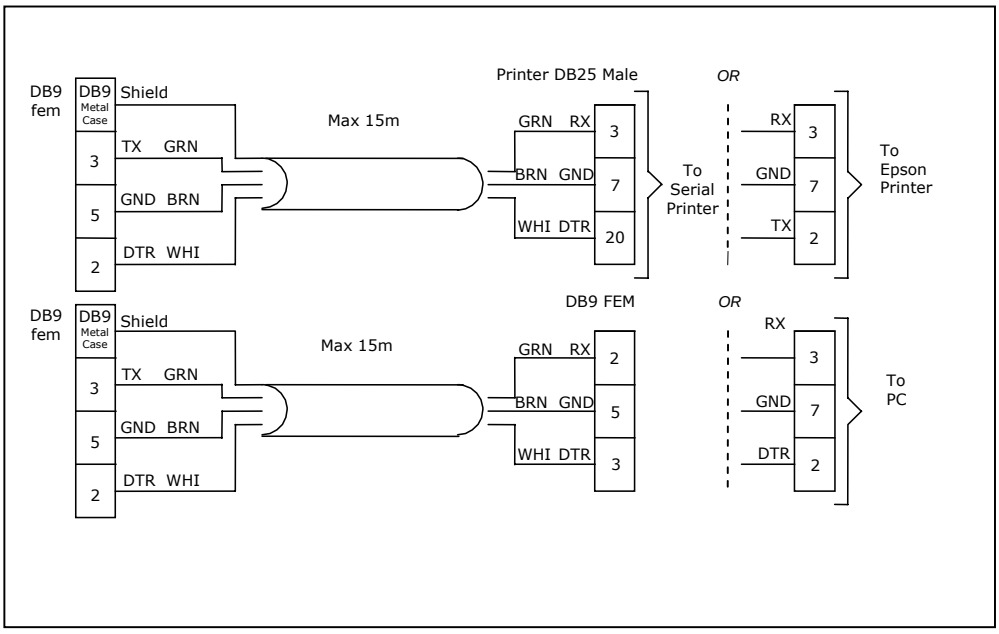


Figure 3 – Printer and PC cables connection diagram

2.4.2 RS485 Cable Connections

The terminal block on the RS485 board enables connecting two pairs of wires (A, B):

- One wire pair for connecting the incoming cable.
- A second wire pair for a daisy-chain connection to the next unit on the RS485 bus.

The RS485 cabling configuration is illustrated in Figure 4 below.

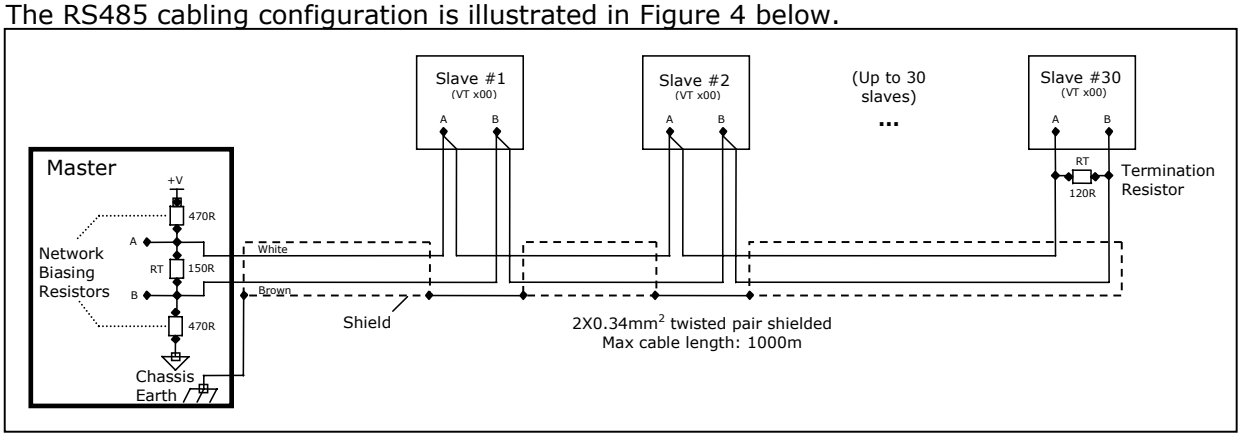


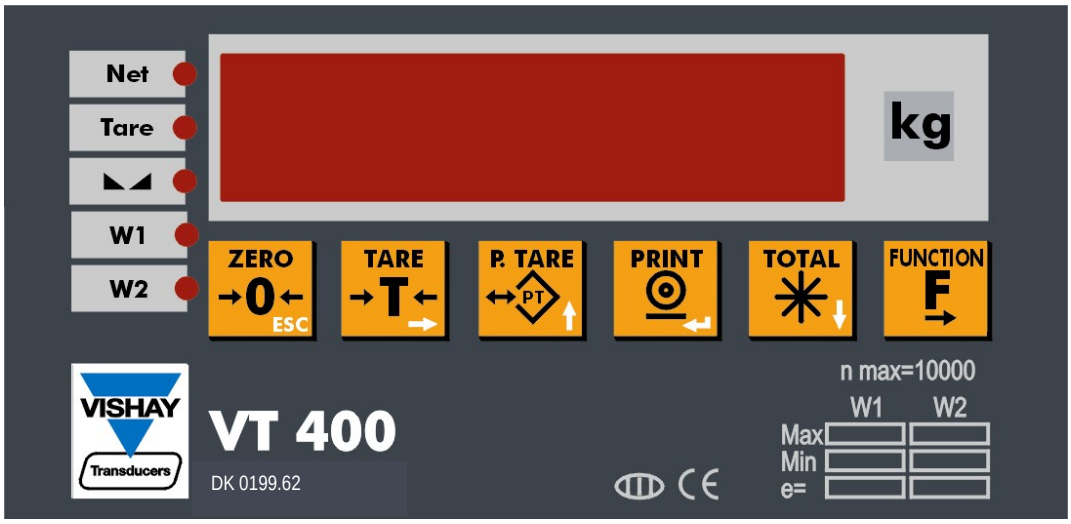
Figure 4 – RS485 cable connection diagram

2.5 Connecting Power

VT400 indicators are powered from an external power supply (24 VDC), or battery. Power should be isolated from other data processing equipment.

Verify that the AC power socket outlet is properly protected. For optimum EMC performance, keep the length of cable shielding inside the enclosure as short as possible.

3 Display, Keys and Menus



The VT400 front panel can be divided into three areas:

- A six-digit display that shows weight information, status information, and the names of menus and functions.
- Six keys, used to perform the most common functions and access a function menu with more advanced options.
- The lower area shows information about the maker, model and certified limits of your indicator.

Five *status annunciators* are located in the top left part of the panel. The red dots provide the current function, range and status information, such as whether the scale has been tared or not.

3.1 The Display

3.1.1 Status Annunciators

Status annunciators are important for understanding what is being shown on the display.

Net	**Net weight**	Active – the display is showing net weight. Inactive – the display is showing gross weight.
Tare	**Tared**	Active – the preset tare value is now being displayed on the screen.
	Stable	Active – the scale is stable (necessary for **ZERO**, **TARE** and **PRINT**). Inactive – the scale is not stable.
W1		The scale is currently in weight range 1.
W2		The scale is currently in weight range 2.

3.1.2 Common Messages Shown on the Display

Message type	Meaning
352.0	**Weight of the item** on the scale.
319.0 (NET active)	**Net weight**.
∩∩∩∩∩∩	**Over range.** The item on the scale weighs more than the maximum capacity of the scale, or the load cell signal is too high.
UUUUUU	**Under range.** The item on the scale weighs less than the minimum capacity of the scale, or the load cell signal is too low.
Fn 06	**Function menu** (see section 3.3). To perform the function currently showing, press **PRINT** (PRINT). To cancel press **ZERO** (ZERO).
Err15	**An error has occurred** (see section 9.1). In some cases, you can ignore the error and continue working by pressing **ZERO** (ZERO).
XXXXXX	**Software model number**, shown during the power-up sequence.
XXXXXX	**Software version issue date**, shown during the power-up sequence.
888888	**Display self-test**, performed during the power-up sequence.
ZeRO	Automatic or manual zeroing is being performed.

3.2 Front Panel Keys

The keys on the front panel serve two functions:

- Performing operations, indicated in black at the center of the key.
- Navigating menus and entering numeric information. Each key's navigation function is indicated in white at its bottom-right corner.

3.2.1 Using Keys to Perform Operations

Key	Description	Related operations
	Press to zero the scale*. Only works if the current weight is in the zero range.	Manual zeroing
	Press once to tare the scale*. Press again to view gross weight.	Taring using current weight
	Press once to view the current tare value.	Tare recall
	When you press this key, the current weight* is printed to the printer and/or output to an attached computer, and added to the accumulated total.	Printing, outputting to computer
	Press once to view the sum of all accumulated weights. Press again to see the number of weights accumulated. Press again to view the current weight.	Accumulated total

* This operation cannot be performed if the weight is not stable.

3.2.2 Using Keys to Navigate and Enter Information

Key	Description
	**Escape.** Cancels the current operation or exits a menu.
	**Next.** When editing multiple digits, moves to the next digit. Only press this key once you have finished editing the current (flashing) digit.
	**Up.** Increments (adds one) to the current digit, or moves to the previous menu option in setup.
	**Enter.** Confirms the current operation or the information entered.
	**Down.** Moves to the next menu option in setup.
	**Function menu.** Enters the function menu.

3.2.3 Editing Multiple Digits

➔ **To edit multiple digits shown on the display:**

1. Take note of the flashing digit. This is the digit you are currently editing. Press ↑ **(P.TARE**) to increment this digit, until it shows the number you need.
2. Press → (**TARE**) to move to the next digit on the right. It should start flashing.
3. Press ↑ (**P.TARE**) to increment the flashing digit, until it shows the number you need.
4. Repeat steps 2 and 3 until you have edited the last digit.
5. Press ↵(**PRINT**) to confirm the number you entered.

3.3 The Function Menu

The function menu allows you to perform advanced operations like high-resolution weighing, selecting printing format and viewing alibi memory. It is accessed by pressing the **FUNCTION** () button.

This subchapter explains how to use the menu and provides a summary of its functions. All operations are explained in more detail further in this document.

3.3.1 Using the Function Menu

➔ **To access a function on the function menu:**

1. Press **FUNCTION** () on the front panel. The display shows `Fn 00`. The left digit should be flashing.
2. Check the number of the function you need (refer to section 3.3.2 below). If the function you need is between 01 and 09, skip to step 4.
3. Press ↑ (**P.TARE**) to increment the left-hand digit (tens). Keep pressing it until it matches the function you need. For example, if you need function 43, press ↑ four times. The left digit should become `4`.
4. Press → (**TARE**) to move to the right-hand digit (units). This digit should start flashing.
5. Press ↑ (**P.TARE**) to increment the right-hand digit (units). Keep pressing it until it matches the function you need. For example, if you need function 43, press ↑ three times. Assuming you entered 4 for the left-hand digit, the display should now show `Fn 43`.
6. Press ↵(**PRINT**) to confirm. The operation associated with the function number you entered is performed.

3.3.2 Function Summary

Function	Description	Refer to
01	**Edit setpoints.** The display shows `SEtP 1` briefly, then the current setpoint value. Use ↑ (**P.TARE**) to change the current digit, then → (**TARE**) to move to the next digit. When you are done, press ↵(**PRINT**). The display shows `SEtP 2` briefly, then the current setpoint value. Edit the second setpoint value using the same procedure.	Section 7.3
06	**High resolution weighing.** Increases the accuracy of the displayed weight by a factor of ten (in other words, the indicator shows an additional digit on the right). The smallest possible resolution is 1 gram. When this function is enabled, the display flashes and you may not print. Press **ZERO** () to cancel and return to normal resolution.	-
20	**Disable serial output.** Prevents the indicator from printing when you press **PRINT** (), even if a printer is connected. (Function activated only if setup parameter **2.8** is set to 1.)	-
21	**Set print output format: Ticket.** Shows weight in the following format: `GROSS:<00.500  kg>` (Function activated only if setup parameter **2.8** is set to 1.)	Section 6.2.1
22	**Set print format: Continuous output.** Used for external display or PC. (Function activated only if setup parameter **2.8** is set to 1.)	Section 6.2.1
23	**Set print format: Print on demand.** For gross weight: `00.300 kgG` For net weight: `00.300 kgG  00.100kgT  00.200kgN` (Function activated only if setup parameter **2.8** is set to 1.)	Section 6.2.1
30	**Enable / disable host computer protocol output (EDP mode).** The display shows `Pro...` Press **PRINT** to disable. The display shows `Pro OFF` briefly. Press **PRINT** again to enable. The display shows `Pro on` briefly. The selection is lost when the unit powers down.	Section 6.2.1
40	**Changing PIN.** Used to change the current Personal Identification Number that enables access to the calibration procedure.	Section 8.1.1

Function	Description	Refer to
48	**Check calibration seal.** Shows the calibration counter, and the status of the physical calibration seal (if used).	-
49	**Setup menus**.	Section 3.4
55	**View an alibi memory record/print ten next records.** Set setup parameter **2.t** to 13 to enable Alibi printing. Press ↵(**PRINT**). The display shows `n 0000` (the Alibi serial number). Choose the required Alibi number . To view the gross weight of an Alibi record, press ↵(**PRINT**). When you are done, press ↵(**PRINT**). The display shows the memory record you requested. If you want to print this and the next nine records, press ↵ (**PRINT**) again.	-
56	**Print all alibi memory records.** Prints the entire contents of alibi memory, including empty or corrupted locations. Set setup parameter **2.t** to 13 to enable Alibi printing. The entire alibi memory will be printed in the format (gross weight): `SN 0001 123.45` Press **ZERO** () to stop printing.	-
57	**Checksum test.** Performs a checksum on each alibi memory, ensuring it is not corrupted. An alibi memory serial number will be displayed in the format `n 0000`. If all records are okay, `PASS` is displayed briefly. If an error is found, `Err 57` is displayed. (This function is only active if setup parameter **2.t** is set to 13.)	-
80	**Load-cell mV meter**. The actual mV output of the scale sensors is displayed.	Section 8.1.3
81	**Display internal A/D count**. The analog-to-digital converter internal count is displayed.	Section 8.1.4
82	**Display version and date**.	-
85	**Analog output test**.	Section 7.4.3
86	**ROM/RAM test**. A validity check is performed on system ROM and RAM.	Section 8.2.1
90	**Display segment test**. All digits go through 0-9 display routine in sequence, after which the character set is displayed.	Section 8.2.2
91	**Keyboard test.** Display blanks. The scan code of any key pressed is shown on the display.	Section 8.2.2

Function	Description	Refer to
93	**I/O test**. Display shows the status of input and outputs.	Section 8.2.3
94	**Print buffer test**. An ASCII file (30h-7Fh) is output to the printer port, with error control.	Section 8.2.4
96	**Display characters received by COM ports**. Any character received by COM 1 is echoed and displayed in ASCII hex on digits 1 and 2. Any character received by COM 2 is echoed and displayed in ASCII hex on digits 5 and 6.	Section 8.2.5
99	**Soft reset.**	-

3.4 Setup Menus

3.4.1 Accessing and Navigating Setup Menus

To enter the setup and calibration menus, either execute function 49, or follow the procedure below.

➔ **To enter the setup and calibration menus:**

1. Turn on the unit.
2. During the self-test routine, while all display segments are on (all 8 on the display), press **PRINT** () momentarily, followed by **TARE** () momentarily.

   Alternatively, press **FUNCTION** (), and access function 49.
3. If the PIN code is activated, the display shows ACCESS briefly. Type the PIN number and then **PRINT** () to get into the calibration menu. The display shows SETUP.
4. Use **TOTAL** () to step through the menus.

The menus displayed depend on whether jumper JP1 is in the sealed position or not (see section 4.4). If it is sealed, the following menus are hidden: **Par**, **CAL**, **INIT** and **A-CAL**.

5. To enter a menu, press **PRINT** ().

3.4.2 Menu Structure

Main menu	Submenu	Description
SETUP	**SETUP 1**	Totalizer enable/disable and key locking.
	SETUP 2	Serial port 1 parameters.
	SETUP 3	Serial port 2 parameters.
	SETUP 4	Tilt Switch parameters.
	SETUP 5	Setpoint parameters.
Par	**0.P, 1.P, 2.P, 3.P, 4.P, 5.P, 6.P, 7.P**	General scale parameters with multiple values.
	8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.A, 8.b	General scale parameters with two possible values.
CAL	**S-CAL (ZEro, SPAN)**	Standard-weights calibration dialog.
	E-CAL (ZEro, SPAN)	Electronic calibration dialog.
STORE	**-**	Permanently saves calibration data and exits setup.
INIT	**-**	Resets scale parameters, configuration and calibration data to manufacturer defaults.
A-CAL	**A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8**	D/A analog output parameters.

3.4.3 Parameter Summary

SETUP > SETUP 1 (General Operating Parameters)

Par.	Description	Values
1.1	**Enable totalizer**. YES enables the totalizer. NO disables it.	0=NO 1=YES
1.2	(Reserved for future use)	
1.3	**Lock ZERO key** ()	0=NO 1=YES
1.4	**Lock TARE key** ()	0=NO 1=YES
1.5	**Lock P.TARE key** ()	0=NO 1=YES
1.6	**Lock PRINT key** ()	0=NO 1=YES
1.7	**Lock TOTAL key** ()	0=NO 1=YES
1.8	**Lock FUNCTION key** ()	0=NO 1=YES

SETUP > SETUP 2 (Com 1 Settings)

Par	Description	Values
2.t	**Print type.** Sets output of communication port 1 (printer port), or disables the port.	00=port disabled; 01=ticket; 02=weight output; 03=demand; 13=alibi memory
2.C	**Print-on-demand character.**	65-90
2.L	**Page length.** Ticket length in linefeeds.	
2.r	**Paper reverse.** Number of reverse linefeeds before printout.	
2.A	**Left margin.** Number of spaces from left margin.	
2.F	**Page header.** Number of linefeeds before printout.	
2.E	**Line termination**.	0=LF 1=CRLF 2=LFCR
2.1	**Printer model**.	0= FANFOLD 1= SLIP TM-295
2.2	(Reserved for future use)	
2.3	**Print below minimum capacity**.	0=NO 1=YES
2.4	(Reserved for future use)	
2.5	(Reserved for future use)	
2.6	**Wait unload**.	0=NO 1=YES
2.7	**Printer error control.** Set to 0 for communication with a PC.	0=NO 1=YES
2.8	**Operator print type change** (Fn 20-30)	0=NO 1=YES
2.d	**Data bits serial channel 1**.	17=7 data bits/even parity 08=8 data bits/no parity

Baud rate is 2400 by default.

SETUP > SETUP 3 (Com 2 Settings)

Par.	Description	Values
3.t	**Instrument communication type**.	00=disabled; 01 =continuous weight output; 02=EDP protocol output; 03=printer protocol output; 65-89=master/slave protocol address
3.1	**Timeout control**.	0=NO 1=YES
3.2	**Handshake**.	0=NO 1=YES
3.3	**Operator disable**.	0=NO 1=YES
3.4	**Host enquiry**.	0=NO 1=YES
3.5	**Remote keyboard commands**.	0=NO 1=YES
3.6	(Reserved for future use)	
3.7	(Reserved for future use)	
3.8	**Debug**.	0=NO 1=YES
3.b	**Baud rate serial number 2**.	24=2400 bps 96=9600 bps 19=19200 bps 38=38400 bps 57=57600 bps
3.d	**Data bits serial channel 2**.	17=7 data bits / even parity 08=8 data bits / no parity 18=8 data bits / even parity

SETUP > SETUP 4 (Tilt Switch)

Par.	Description	Values
4.t	**Time delay**, after closing the contact, for the display to lock. This is also the time for the display to unlock after the contact is opened. This parameter has several special values: • 91 – Tare scale on the rising edge of input. Setpoints always enabled. • 92 – Print on the rising edge of the input. Setpoints always enabled. • 93 – Setpoints active when input is high. Setpoints inactive when input is low. • 94 – Scale is tared at the rising edge of input. If taring is successful, setpoints are activated. If input is low, setpoints are inactive. • 95 – When input is low, scale 1 is selected and displayed. When input is high, scale 2 is selected and displayed. • 96 – Reset scale to zero.	00=disabled 01-90 (x 0.1 seconds) 91-96=special options

SETUP > SETUP 5 (Setpoints)

Par.	Description	Values
5.1, 5.2	**Setpoint 1 output.**	5.1=0 and 5.2=0: normal 5.1=1 and 5.2=0: no motion 5.1=0 and 5.2=1: error
5.3, 5.4	**Setpoint 2 output.**	5.3=0 and 5.4=0: normal 5.3=1 and 5.4=0: zero 5.3=0 and 5.4=1: net
5.6	**Net / gross** for both setpoints.	0=net 1=gross
5.7	**Normally open / closed** for both setpoints.	0=normally open 1=normally closed

A-CAL (Analog Output)

Par.	Description	Values
A.1	**Standard / custom zero and span**. 0 specifies that the scale should output 0mA at zero input and 20mA at maximum input (or 0V at zero and 10V at max). 1 opens a dialog, after **A.8**, that allows you to enter custom zero and span values. Press **PRINT** to confirm; the display shows `0 XX.XXX`. Enter the D/A output at zero, in voltage or mA, and press **PRINT**. The display shows `F XX.XXXX`. Enter the D/A output at maximum input, in voltage or mA, and press **PRINT**.	0 = Standard (20mA max) 1 = User defined Zero and Span
A.2	(Reserved for future use)	
A.3	**Error output level**. Specifies whether scale errors should be indicated as a low or high signal.	0 = Low (0mA) 1 = High (24mA)
A.4	**Current / voltage**. This parameter must correspond to the hardware jumper, which defines whether output should be in current or voltage (see section 7.4.1). The default setting is voltage (1).	0 = Current 1 = Voltage
A.5	**Net / gross**. Specifies whether the indicator should always output gross weight, or output net weight when tare is active.	0 = Net weight 1 = Gross weight

A-CAL (Analog Output, cont.)

Par.	Description	Values
A.6	**Effective Range for current output**. Sets the range to 0-20mA or 4-20mA. Relevant only if **A.4** and the hardware jumper are set to current.	0 = 0-20mA 1 = 4-20mA
A.7	**Resolution**. Specifies whether output should be in high resolution if the display is showing high resolution.	0 = Display 1 = Internal
A.8	**Operation**. Enables and disables the analog output.	0 = Disabled 1 = Enabled

4 Calibration

Before you can calibrate the scale, you must ensure that jumper JP1 is not in the sealed position (see section 4.4). There are two ways to calibrate the VT400:

- Standard weights calibration, in which you record the center of zero, and then place a known weight on the scale and enter its weight (see section 4.1).
- Electronic calibration, in which you enter the mV value of the minimum and maximum weight (see section 4.2).

Both of the above are performed using the **CAL** setup menu.

After calibrating the scale, you should store calibration data in persistent memory (see section 4.3), and seal the calibration lock (see section 4.4).

➔ **To calibrate the unit:**

1. Power up the VT400.
2. Allow a minimum of 10 minutes for warm-up.
3. Proceed with calibration as described in the following pages.
4. Store the calibration data (see section 4.3).
5. Seal the unit (see section 4.4).

4.1 Calibration with Standard Weights (S-CAL)

Calibration with standard weights is done in two stages:

- Zero calibration, in which you take a weight measurement when there is nothing on the scale (see section 4.1.1). This is also called dead-load adjustment.
- Span calibration, in which you place a known weight on the scale, and manually enter its correct weight (see section 4.1.2).

You must perform both of the above for the scale to be calibrated properly.

After calibrating the scale, you must save the values in permanent memories by entering the setup menus and selecting the **STORE** option (see section 4.3). It is also advised to lock calibration (see section 4.4).

4.1.1 Zero (Dead-Load) Calibration

➔ **To perform zero calibration:**

1. Enter the setup menus and use **TOTAL** () to scroll to the **CAL** menu. Press **PRINT** () to enter the menu.
2. Press **PRINT** () to enter the **S-CAL** menu.

3. Press **PRINT** () to select the **ZEro** option (zero calibration).
4. The display shows `E Scl`. Clear the scale, and wait about 10 seconds.
5. Press **PRINT** () to record the zero position. The display counts down for about 10 seconds (50 measurements are taken and an average is calculated).
6. The display should now show 0. If the zero point is not accurate, press **ZERO** () and go back to step 3.

4.1.2 Span Calibration

➔ **To perform span calibration:**

1. Enter the setup menus and use **TOTAL** () to scroll to the **CAL** menu. Press **PRINT** () to enter the menu.
2. Press **PRINT** () to enter the **S-CAL** menu.
3. Use **TOTAL** () to scroll to the **SPAN** option, and press **PRINT** () to select it.
4. The display shows the maximum capacity of the scale. Enter the correct calibration weight, using **P.TARE** () to edit the current digit, and **TARE** () to move to the next digit.
5. Press **PRINT** () to confirm the calibration weight.
6. The display shows `Add Ld`. Place the calibration weight on the scale, and wait about 10 seconds.
7. Press **PRINT** (). The display counts down for about 10 seconds, and then shows the calibration weight.
8. If the weight shown is not accurate, press **ZERO** () and go back to step 4.

4.2 Electronic Calibration (E-CAL)

Electronic calibration involves setting two values, using the indicator keypad:

- The signal level in mV, corresponding to the zero, or dead-load point (see section 4.2.2).
- The signal level in mV, corresponding to the maximum capacity of the scale (see section 4.2.3).

To learn how to calculate these values from the load cell specifications provided by the manufacturer, see section 4.2.1 below. You must perform both of the above for the scale to be calibrated properly.

After calibrating the scale, you must save the values in permanent memories by entering the setup menus and selecting the **STORE** option (see section 4.3). It is also advised to lock calibration (see section 4.4).

4.2.1 Calculating Calibration Values

Consider the following example. A scale has maximum capacity 30/60kg, e=0.010/0.020kg, with 4 load cells, each of rated capacity 50kg (2mV) and dead load 1.940kg. The load cell data, as noted in the manufacturer data sheet, is shown in the following table.

Load cell	Output at 50kg	Zero balance
L/C1	1.9793mV	0.0257mV
L/C2	1.9392mV	0.0276mV
L/C3	1.9577mV	0.0553mV
L/C4	1.9640mV	-0.0022mV

➔ **To calculate the dead-load and span calibration values:**

1. Calculate an average of the load cells' rated output. In the example above, this equals (1.9793+1.9392+1.9577+1.9640)/4=1.9600mV.
2. Calculate the combined output of the load cells when the scale is at maximum capacity. In the example above, this equals 1.9600x60/4x50=**0.5880 mV/V**. This is the *span calibration value*.
3. Calculate an average of the load cells' zero balance. In the example above, this equals [0.0257+0.0276+0.0553+(-0.0022)]/4=0.0266mV.
4. Calculate the scale dead-load. In the example above, this equals 1.9600mV*[1.940Kg/(4*50Kg)]=0.0190mV.
5. Calculate the overall dead-load by adding together the load cell zero balance and the scale dead-load (calculated in step 2). In the example above, this equals 0.0266+0.0190=**0.0456mV**. This is the *dead-load calibration value*.

4.2.2 Setting Zero Calibration (Dead-Load) Value

➔ **To set the zero calibration value electronically:**

1. Enter the setup menus and use **TOTAL** () to scroll to the **CAL** menu. Press **PRINT** () to enter the menu.
2. Press **PRINT** () to enter the **E-CAL** menu.
3. Press **PRINT** () to select the **Zero** option (zero calibration).
4. Enter the overall mV of the dead-load (see section 4.2.1 to learn how to calculate it). Use **P.TARE** () to edit the current digit and **TARE** () to move to the next digit.
5. Press **PRINT** () to record the zero calibration value. The display shows the corresponding weight.

4.2.3 Span (Max. Capacity) Calibration

➔ **To set the span calibration value electronically:**

1. Enter the setup menus and use **TOTAL** () to scroll to the **CAL** menu. Press **PRINT** () to enter the menu.
2. Press **PRINT** () to enter the **E-CAL** menu.
3. Use **TOTAL** () to scroll to the **SPAN** option, and press **PRINT** () to select it.
4. Enter the overall mV of the scale's maximum capacity (see section 4.2.1) to learn how to calculate it). Use **P.TARE** () to edit the current digit and **TARE** () to move to the next digit.
5. Press **PRINT** () to confirm the maximum capacity calibration value. The display shows the corresponding weight.

4.3 Storing Calibration Data

After calibrating the scale (using either method) or the analog output, calibration data is stored in volatile memory only, and so it is lost when the indicator powers down. To store the calibration data permanently, follow the procedure below.

➔ **To perform span calibration:**

1. Enter the setup menus and use **TOTAL** () to scroll to the **STORE** option.
2. Press **PRINT** (). The indicator exits the setup menus and re-initializes.

4.4 Locking and Unlocking Calibration

An internal jumper (JP1, located on the main printed circuit board next to the analog circuit) must be removed to allow access to configuration and calibration parameters. One way to seal the indicator is to prevent access to this jumper. This is done by placing a brittle plastic sticker over one of the screws that keeps the cabinet closed.

The indicator also has an *Audit Trail Counter*, which is incremented every time weight parameters or calibration are changed, regardless of whether the change was saved in EEPROM or not. This counter allows the authorities to check if any calibration attempt has been made since the last inspection.

A label with an inscribed count (all digits permanently printed and suffixed by a hyphen) is placed on the rear side of the instrument. The label is designated CAL-Nr and may not be removed without destroying it.

Seals bear the verification mark of a notified body or alternative mark of the manufacturer according to Annex II, section 2.3 of the Directive 90/384/EEC.

4.4.1 Sealing Indicator Enclosure with Stickers

After calibration, you must seal the indicator with two stickers:

- A non-removable label, to prevent unauthorized opening of the indicator enclosure (Figure 5)
- A lead wire seal or hard plastic sticker, to prevent unauthorized tampering with the load cell connector (Figure 6)

Figure 5 – Non-removable sticker

Figure 6 – Lead wire seal / hard plastic sticker

➔ **To seal the indicator:**

- Refer to Figure 7 below for the non-removable sticker, and to Figure 8 for the lead seal / non-removable sticker. You must apply both stickers.

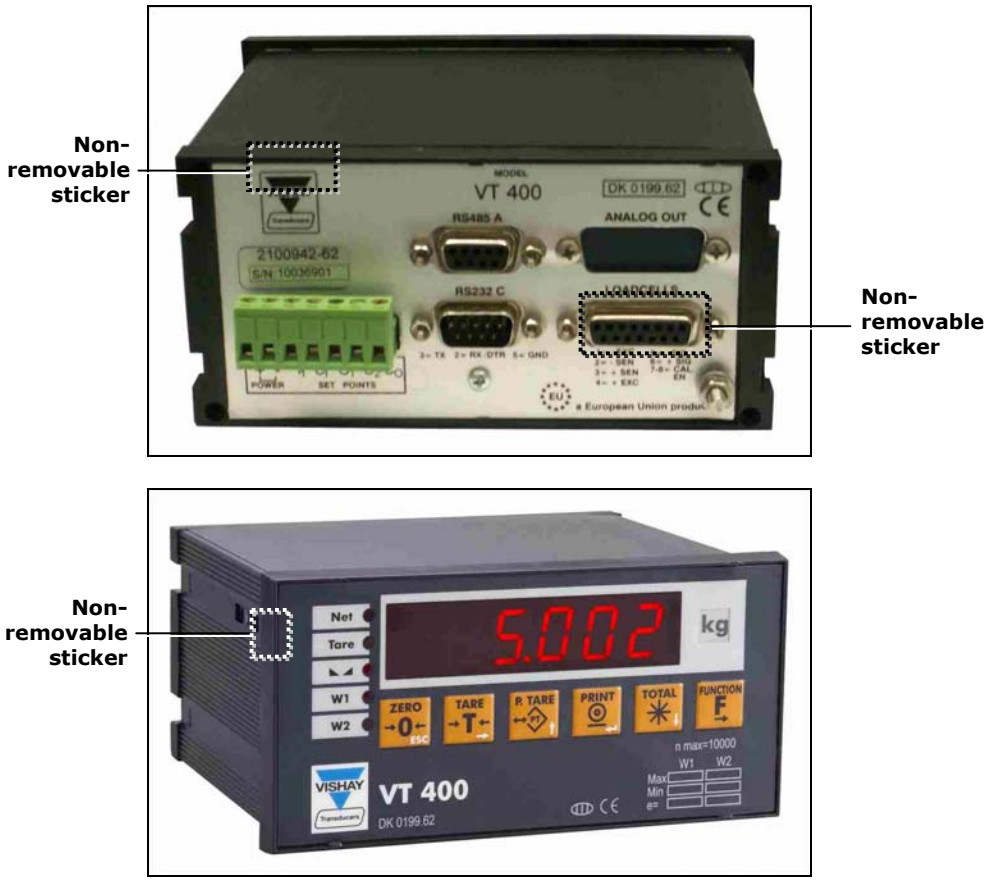


Figure 7 – Desktop model, sealing with non-removable sticker

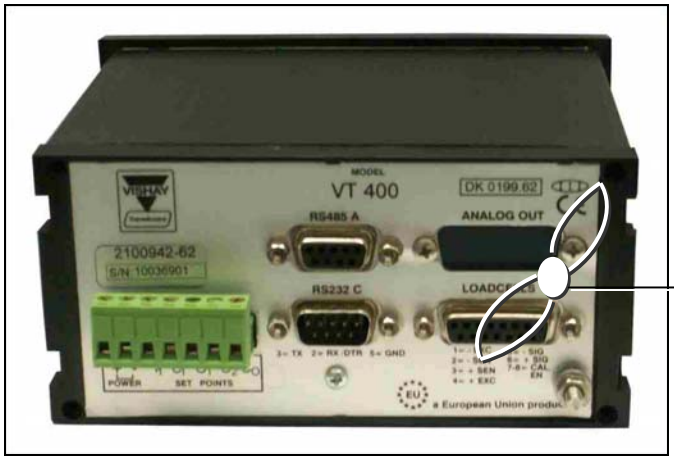


Figure 8 – Desktop model, sealing with lead seal / non-removable sticker

4.4.2 Securing Load Receptor

You can inscribe the serial number of the load receptor as part of the indicator identification label.

The load receptor bears the serial number of the indicator on its data plate.

4.4.3 Checking Seal Status and Audit Trail Counter

From time to time, it is advisable to check whether the jumper is still in the sealed position, and that the audit trail counter has not changed.

➔ **To check seal status and audit trail counter:**

Execute function 48. If JP1 is currently in the sealed position, the word SEALED appears on the display briefly. Following this, the audit trail counter is displayed.

5 General System Parameters

Two of the VT400 setup menus provide access to general system parameters, which affect how the scale operates:

- The **PAR** menu contains parameters including the number of display digits, the position of the decimal point, the A/D gain and the zero range (see section 5.1).
- The **SETUP 1** submenu, inside the **SETUP** menu, allows you to enable and disable the totalizer, and lock or unlock keys.

Other setup menus allow you to calibrate the scale (**CAL** menu; see chapter 4); set communication parameters (**SETUP 2** and **SETUP 3**; see chapter 6); and input/output parameters (**SETUP 4**, **SETUP 5** and **A-CAL**; see chapter 7).

5.1 PAR Menu

5.1.1 Accessing the Menu and Editing Parameters

➔ **To access the PAR menu:**

1. Turn on the unit.
2. During the self-test routine, while all display segments are on (all 8 on the display), press **PRINT** () momentarily, followed by **TARE** () momentarily.

   Alternatively, press **FUNCTION** (), and access function 49.
3. If the PIN code is activated, the display shows **ACCESS** briefly. Type the PIN number and then **PRINT** () to get into the calibration menu. The display shows **SETUP**.
4. Use **TOTAL** () to scroll to the **PAR** menu.
5. Press **PRINT** () to enter the menu.

➔ **To edit parameters in the PAR menu:**

1. The current parameter number is shown on the display. Use **PRINT** () to scroll to the parameter you need (see the following section for descriptions of parameters).
2. To edit the parameter value, use **P.TARE** () to increment the current digit and **TARE** () to move to the next digit (if any).
3. When the display is showing the required value, press **PRINT** () to confirm your selection.

5.1.2 PAR Menu Parameters

Par.	Description	Values
1.P	**Number of display digits**.	4, 5, 6
2.P	**Number of digits after decimal point**. Defines the position of the decimal point.	0-5
3.P	**Display resolution**.	1-200
4.P	**First two digits of weighting range**.	00-99
5.P	**Digital filter**. If x is entered, the filter averages 2^x samples.	0-5
6.P	**Number of conversions per second**.	3, 7, 14, 28, 57, 70
7.P	**No-motion samples**. If x is entered, no-motion samples are 2^x.	1-7
8.1	**Auto-zero maintenance**.	0=NO 1=YES
8.2	**Auto-zero at power up**.	0=NO 1=YES
8.3	**Dual digital filter** (Antiflicker)	0=NO 1=YES
8.4	**Automatically clear A/D converter error** (Error 05). NO specifies that, when the A/D converter is enabled, errors are automatically cleared when the cause is no longer present. YES specifies that A/D converter errors should remain on the display until the operator presses **ESC**.	0=NO 1=YES
8.5	(Reserved for future use)	
8.6	**Leading zero blank**.	0=NO 1=YES
8.7	**Load cell amplifier gain adjustment (A/D Gain)**. 2mV/V setting allows maximum utilization of 1.75mV/V 4mV/V setting allows maximum utilization of 3.75mV/V	0=2mV/V (1.75mV/V utilization) 1=4mV/V (3.75mV/V utilization)
8.8	**AC/DC excitation**. AC sets load cell excitation to AC, and specifies that polarity excitation should be switched at the conversion rate. Switching excitation results in more stable zero. DC sets load cell excitation to DC.	0=AC 1=DC
8.A	**Zero range**. Some operations, including taring and printing, are only active within the zero range.	0=2% 1=10%
8.b	**Dual interval or range**. This parameter is not relevant if **0.P**=00.	0=interval 1=range
8.c	**Unit selection.** Specifies the weight unit.	kg=kilograms lb=pounds
0.P	**First two digits of weighing range**, for which the lower display division is automatically selected. If set to 00, disables interval / range.	00-99

5.2 SETUP 1 (Inside SETUP Menu)

5.2.1 Accessing the Menu and Editing Parameters

➔ **To access the SETUP 1 menu:**

1. Turn on the unit.
2. During the self-test routine, while all display segments are on (all 8 on the display), press **PRINT** (PRINT) momentarily, followed by **TARE** (TARE) momentarily.

   Alternatively, press **FUNCTION** (FUNCTION), and access function 49.
3. If the PIN code is activated, the display shows **ACCESS** briefly. Type the PIN number and then **PRINT** (PRINT) to get into the calibration menu. The display shows **SETUP**.
4. Press **PRINT** (PRINT) to enter the **SETUP 1** menu.

➔ **To edit parameters in the SETUP 1 menu:**

1. The current parameter number is shown on the display. Use **PRINT** (PRINT) to scroll to the parameter you need (see the following section for descriptions of parameters).
2. To edit the parameter value, use **P.TARE** (P.TARE) to increment the current digit and **TARE** (TARE) to move to the next digit.
3. When the display is showing the required value, press **PRINT** (PRINT) to confirm your selection.

5.2.2 SETUP 1 Parameters

Par.	Description	Values
1.1	**Enable totalizer**. YES enables the totalizer. NO disables it.	0=NO 1=YES
1.2	(Reserved for future use)	
1.3	**Lock ZERO key** (ZERO).	0=NO 1=YES
1.4	**Lock TARE key** (TARE).	0=NO 1=YES
1.5	**Lock P.TARE key** (P.TARE).	0=NO 1=YES
1.6	**Lock PRINT key** (PRINT).	0=NO 1=YES
1.7	**Lock TOTAL key** (TOTAL).	0=NO 1=YES
1.8	**Lock FUNCTION key** (FUNCTION).	0=NO 1=YES

6 Serial Communication

Communication and printer parameters can be set in the **SETUP 2** and **SETUP 3** submenus of the **SETUP** menu.

6.1 Serial Ports Configuration

VT400 has two serial ports, designated port 1 and port 2:

- Port 1 is an RS232 port.
- Port 2 is an optional port installed on order, and can be either RS232 or RS485.

6.1.1 RS232 Serial Port

The port is used to connect to serial printers or personal computers.

General	Asynchronous serial ASCII, RS232C standard, full duplex.
Protocol	2400 baud, 1 start, 7 data/even parity or 8 data/no parity, 1 stop bit.
Handshake	DTR BUSY per character for fanfold printers or REQUEST PAPER END STATUS for EPSON TM-295 slip printer.
Connection	DB9 male on rear panel (J1 or J3). Three-conductor shielded cable, max distance 15m. Tx = Pin 3 Rx/DTR = Pin 2 GND = Pin 5

6.1.2 RS485 Serial Port

Used to connect to a host computer, remote printer, remote display, etc.

General	Asynchronous serial ASCII, RS485 half duplex.
Protocol	2400 to 57600 baud, 1 start, 7 or 8 data, 1 even parity, 1 stop bit.
Connection	DB9 female on rear panel. Two-conductor twisted-pair shielded cable, max distance 1000m. A termination resistor 120R may be connected by shorting pins 8 and 9. A = Pin 6 B = Pin 7

6.2 Setting Port Output Parameters

6.2.1 Setting Port 1 Output

You can use setup parameter **2.t** to determine the output for port 1. The parameter accepts the following values:

- 00 – port disabled.
- 01 – ticket print format. See section 6.3.1
- 02 – continuous weight output. See section 6.3.2.
- 03 – print on demand. See section 6.3.3.
- 13 – transmit alibi memory. See section 6.3.4.

6.2.2 Setting Port 2 Output

You can use setup parameter **3.t** to determine the output for port 2. The parameter accepts the following values:

- 00 – port disabled.
- 01 – continuous weight output. See section 6.3.2.
- 02 – EDP protocol output. See section 6.3.6.
- 03 – printing data from local printer on remote printer. See section 6.3.7.
- 65 through 89 – participate in a network of several indicators as slave, with this address. See section 6.3.8.

6.3 Output Types

6.3.1 Local Printer

Works with port 1. A slip is printed on the printer connected to the port each time the user presses **PRINT** (). One print format is available, shown below.

```
GROSS : <123.40 kg>
```

6.3.2 Continuous Weight Output

Works with ports 1 and 2 (RS232 or RS485). Net weight and status information is transmitted continuously. No handshake is required. Used mainly for remote display or PC. The structure of the transmitted data block is shown below.

Data Block Composition

Byte	Name	Description		
1	Weight status	Bit 0:	0=Normal	1=No weight display
		Bit 1:	0=Gross	1=Net
		Bit 2:	0	1=Auto zero
		Bit 3:	0=Within range	1=Out of range
		Bit 4:	0=No standstill	1=Standstill
		Bit 5:	0=Normal	1=Under minimum weighing range
		Bit 6:	Always 1	
		Bit 7:	Zero or parity	
2	Polarity	"+" or "-".		
3-8	Net weight	6 digits, including decimal point if any.		
9	Sync	Carriage return (0D hex) for end of transmission.		

6.3.3 Print on Demand

Works With Port 1 (RS232). Weight data is transmitted every time a character is received from a connected peripheral. The demand character is programmed using setup parameter **2.C**, e.g. "1" 49d or 31 hex.

6.3.4 Alibi Transmit

Works With Port 1 (RS232).

Transmits alibi serial number and gross weight for each transaction, when the **PRINT** key is pressed. The record is transmitted in the following format:

```
SN 1234  012340 kgG
```

6.3.5 Alibi Mode Commands

When Alibi mode is active (**2.t**=03), these operations can be executed.

Transmit Displayed Weight

This is executed when ASCII character ? (3F hex) is received. The output data block is as shown below:

Byte	Name	Description		
1	Weight status	Bit 0:	0=Normal	1=No weight display
		Bit 1:	0=Gross	1=Net
		Bit 2:	0=	1=Auto zero
		Bit 3:	0=Within range	1=Out of range
		Bit 4:	0=No standstill	1=Standstill
		Bit 5:	0=Normal	1=Under minimum weighing range
		Bit 6:	Always 1	
		Bit 7:	Zero or parity	
2	Polarity	"+" or "-"		
3-8	Weight	6 digits, including decimal point if any		
9	Sync	Carriage return (0D hex) for end of transmission.		

Command "ZERO"

Equivalent to pressing the front panel Zero key. This is executed when ASCII character `0` (30 hex) is received. No data is returned to the host. Execution of the command may be verified by examining the weight (command ?).

Print on Demand Character

When a demand character is received the unit saves the weight in its Alibi flash. It then transmits the Alibi number and the weight, for example: `1234 012.340 kg`

The demand character may be programmed through **SETUP** > **SETUP 2**, setting **2.c**=65-90(A-Z). `A` (41h) will generate and transmit the new Alibi number; `a` (61h) will repeat the last Alibi number (in the case where the message was not received properly).

6.3.6 EDP Protocol Output

Works With Port 2.

Transmits weight measurements to a host computer, according to the currently-selected print format, with or without an ENQ prompt, and with or without an ACK/NAK handshake (see 'Relevant Setup Parameters' below).

The EDP protocol works when more than one indicator is connected to the host PC. It is also more flexible than print on demand, allowing for more complex operations. It can also transmit more than just the weight measurement shown on the display, because it sends data according to the currently-selected print format.

Full Protocol Workflow

1. Within 5 seconds of initialization, the PC requests data by sending an ENQ (05h) command. If it doesn't send an ENQ, the indicator shows Error 30 (host not ready).
2. After the **PRINT** () button is pressed, the indicator transmits weight information according to the currently-selected print format, using the standard data block composition (shown below).
3. Within 5 seconds of transmission, the PC either:
   - Acknowledges receiving the data properly, by sending an ACK (06h) command.
   - Notifies the indicator the data was not properly received, by sending a NAK (15h) command.
   - Does not respond, in which case the indicator shows error 33 (host does not acknowledge).
4. If the host responded with a NAK command, steps 2 and 3 are repeated. The number of repeats is unlimited.

Relevant Setup Parameters

- **3.1** – timeout control. `0`=No; `1`=Yes. Turning off timeout removes the 5-second constraint in workflow steps 2 and 4. Errors 30 or 33 are never shown.
- **3.2** – handshake. `0`=No; `1`=Yes. Turning off handshake removes steps 4 and 5 of the protocol workflow - the indicator sends data blocks on demand, without waiting for a response.
- **3.3** – operator disable. `0`=No; `1`=Yes. If this option is turned on, an indicator may interrupt the protocol by pressing any key on the indicator keypad.
- **3.4** – host enquiry. `0`=No; `1`=Yes. Turning off host enquiry specifies that the indicator should send weight information continuously, not on demand.

Data Block Composition

Character/s	Description
STX (02h)	Start of transmission.
ASCII (any)	ASCII data identical to the data printed.
ETX (03h)	End of transmission.
BCC	Block check character (XORSUM of all data characters STX, ETX inclusive).

6.3.7 Remote Printer Output

Works with Port 2 (RS232 or RS485). Used to transmit the data printed on the local printer to a remote printer. No handshake is required.

6.3.8 Master-Slave Protocol Output

Works with Port 2 (RS232 or RS485). By setting port 2 output method (parameter **3.t**) to any number between 65 and 89, you specify that the indicator should participate in a network of several indicators. The number set in **3.t** is this indicator's network address. For more details on the master-slave protocol supported by the VT400, see Appendix B.

7 Outputs and Digital Input

The VT400 is able to interface with weighing automation systems, using two optoisolated outputs (digital setpoints) and one digital input. There is also an analog output configuration.

- The digital outputs (setpoints) are triggered when the scale reads an upper weight threshold, defined by the user. There is a separate threshold for each setpoint.
- The analog output configuration consists of a galvanically-isolated D/A converter, generating either voltage or current output. Relevant parameters can be modified using the **A-CAL** dialog (see section 7.4).
- The digital input is used as a tilt switch. When a signal is received on the input cable, the display locks for a certain period of time.

7.1 Specifications

7.1.1 Digital Outputs

- Transistor output open collector positive common.
- 24VDC + 10% / 100mA per output.
- Max off: State voltage 30VDC / leakage 100µA.
- Optoisolated to 2.5KV.
- Short-circuit protected.
- 2ms maximum delay for both on and off positions.

7.1.2 Analog Outputs

- Galvanically-isolated D/A converter.
- Circuit may be operated as current output or voltage output.
- Output is capable of driving 20mA into 1KΩ load.
- Current output values: 0-20mA, 4-20mA, 0-24mA.
- Voltage output values: 0-10V.

7.1.3 Digital Input (Tilt Switch)

- 9-24VDC, positive common optoisolated to 2.5KV.
- Input resistance 3.3KΩ.
- 2ms maximum delay for both on and off positions.

7.2 Connecting Digital Outputs and Tilt Switch

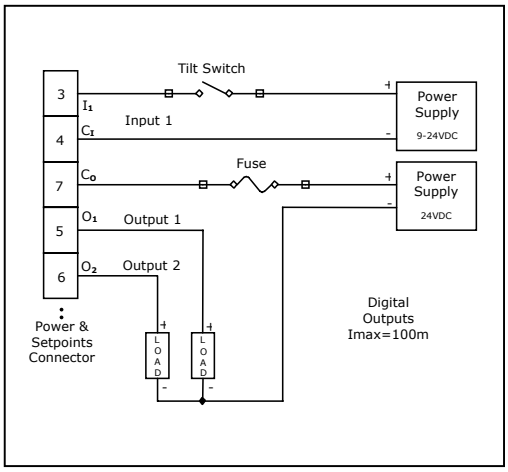


Figure 9 – Digital output and tilt switch connection diagram

7.3 Setting Thresholds for Digital Setpoints

Each setpoint has an upper weight threshold that triggers it. For example, if you set a threshold of 13kg for setpoint 1, nothing will happen as long as the items on the scale weigh less than 13kg. As soon as the weight reaches 13kg, or more, the setpoint will be switched on (if normally off) or to off (if normally on).

You can use the two setpoints to set an upper and lower range for a production operation. For example, if the weight of a product drops below the threshold for setpoint 1, or goes above the threshold for setpoint 2, it can be rejected.

Setpoints can be activated either by net weight value or by gross weight, depending on how it was defined in setup.
In **GROSS** the setpoint will be activated when the gross weight reaches the target value either by weight accumulation or by weight loss (in case that the starting load was above the setpoint)
In **NET** mode the setpoint will be activated either when:

a. Net weight reaches the target weight (for weight accumulation applications) or:
b. Net weight reaches the NEGATIVE value of the target weight (for weight loss applications)

Setpoints can be either normally open or normally closed, depending on how it was defined in setup.

➔ **To edit weight thresholds for both setpoints:**

1. Press **FUNCTION** (F). The display shows `Fn 00`. The left zero flashes.

2. Editing setpoints is function 01, so press → (**TARE**) to move to the second digit. It starts flashing.
3. Press ↑ (**P.TARE**) once. The display should now show `Fn 01`.
4. Press **PRINT** () to confirm. The display shows `SEtP 1` briefly. Then it shows the current threshold for setpoint 1. The extreme-left digit flashes.
   - If you don't want to change this threshold, press **PRINT** () and skip to step 6.
   - If you do want to change it, proceed to the next step.
5. Enter a new threshold value. To do this, press ↑ (**P.TARE**) to change the current digit, then → (**TARE**) to move to the next digit. To finish, press **PRINT** ().
6. The display now shows `SEtP 2` briefly, then the current threshold for setpoint 2. The extreme-left digit flashes.
   - If you don't want to change this threshold, press **PRINT** () and skip to step 8.
   - If you do want to change it, proceed to the next step.
7. Enter a new threshold value. To do this, press ↑ (**P.TARE**) to change the current digit, then → (**TARE**) to move to the next digit. When you are done, press **PRINT** ().
8. The threshold values are saved in EEPROM memory.

7.3.1 Parameters for Digital Outputs

The following parameters can be edited by accessing **SETUP** > **SETUP 5**.

Par.	Description	Values
5.1, 5.2	**Setpoint 1 output**.	5.1=0 and 5.2=0: normal 5.1=1 and 5.2=0: no motion 5.1=0 and 5.2=1: error
5.3, 5.4	**Setpoint 2 output**.	5.3=0 and 5.4=0: normal 5.3=1 and 5.4=0: zero 5.3=0 and 5.4=1: net
5.6	**Net / gross for both setpoints**.	0=net 1=gross
5.7	**Normally open / closed for both setpoints**.	0=normally open 1=normally closed

7.4 Configuring Analog Output

The analog output channel allows the indicator to communicate with PLC devices, using one of the following two methods:

- Converting load cell input into voltage (0-10V)
- Converting load cell input into current (0-20mA or 4-20mA)

This feature is only active if your indicator is equipped with an optional analog output board. Section 7.4.1 below explains how to connect the analog output board, and set a hardware jumper to define which of the two output methods to use.

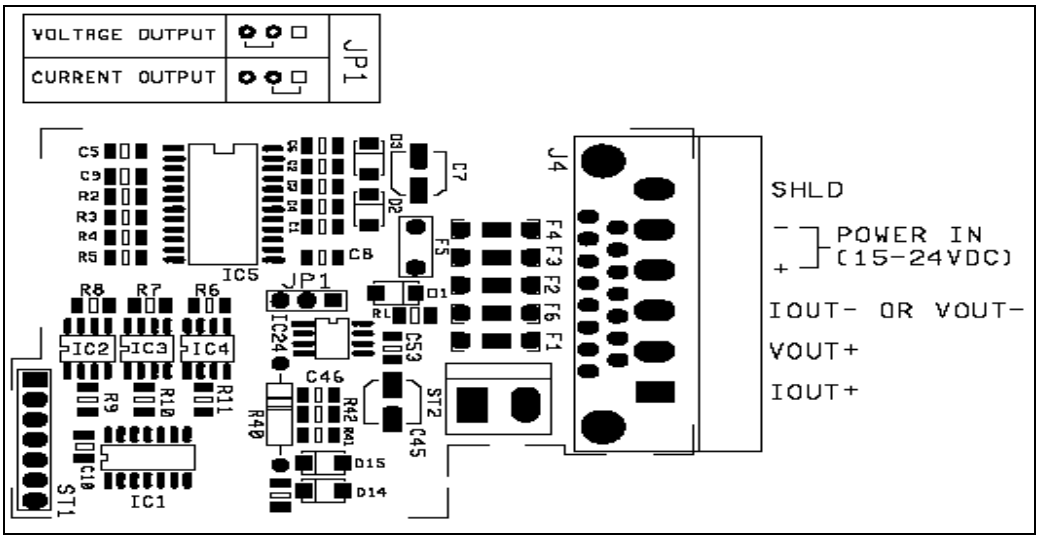
After connecting the board and setting the jumper, you can set analog output parameters using the **SETUP** > **A-CAL** menu (see section 7.4.2).

7.4.1 Connecting PCB and Setting Jumper

In order to use analog output, the option PCB (PCB 761) must be connected to the VT400. Jumper JP1 determines the output mode – current or voltage.

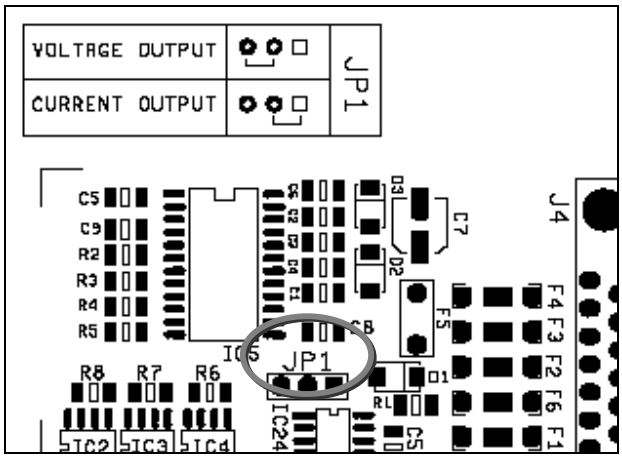
➔ **To connect the analog output PCB:**

1. Connect pins as follows:
   - For current output, connect pin 1 (current output, +) and pin 3 (common).
   - For voltage output, connect pin 2 (voltage output, +) and pin 3 (common).
2. Connect an external power supply of 24VDC, using pins 4 and 5:
   - Pin 4 – power in (+).
   - Pin 5 – power in (-).



➔ **To set output mode jumper (JP1):**

Set jumper JP1 to the appropriate position, to define voltage output or current voltage, as shown in the image below.



7.4.2 Setting Analog Output Parameters

The output can be set to the standard calibration, where 0 on the weight display is output as 0mA or 4mA, and max on the display is output as 20mA.

Alternatively, you can edit these zero and span calibration values. This is controlled through the **A.1** parameter, which, when set to 1, opens a dialog that allows you to enter mA values for zero and span.

There are several other analog output parameters, detailed in the table below.

Par.	Description	Values
A.1	**Standard / custom zero and span**. 0 specifies that the scale should output 0mA at zero input and 20mA at maximum input (or 0V at zero and 10V at max). 1 opens a dialog, after A.8, that allows you to enter custom zero and span values. Press **PRINT** to confirm; the display shows `0 XX.XXX`. Enter the D/A output at zero, in voltage or mA, and press **PRINT**. The display shows `F XX.XXXX`. Enter the D/A output at maximum input, in voltage or mA, and press **PRINT**.	0 = Standard (20mA max) 1 = User defined Zero and Span
A.2	(Reserved for future use)	
A.3	**Error output level**. Specifies whether scale errors should be indicated as a low or high signal.	0 = Low (0mA) 1 = High (24mA)

Par.	Description	Values
A.4	**Current / voltage**. This parameter must correspond to the hardware jumper, which defines whether output should be in current or voltage (see section 7.4.1). The default setting is voltage (1).	0 = Current 1 = Voltage
A.5	**Net / gross**. Specifies whether the indicator should always output gross weight, or output net weight when tare is active.	0 = Net weight 1 = Gross weight
A.6	**Effective range for current output**. Sets the range to 0-20mA or 4-20mA. Relevant only if A.4 and the hardware jumper are set to current.	0 = 0-20mA 1 = 4-20mA
A.7	**Resolution**. Specifies whether output should be in high resolution if the display is showing high resolution.	0 = Display 1 = Internal
A.8	**Operation**. Enables and disables the analog output.	0 = Disabled 1 = Enabled

7.4.3 Calibrating D/A Converter

➔ **To calibrate D/A converter (0-10V):**

1. Place jumper JP1 on PCB (761) for voltage output.
2. Power up the unit, enter the setup menus and enter the **A-CAL** menu.
3. Set parameters as follows: **A.1**=1; **A.2**=0; **A.3**=0; **A.4**=1; **A.5**=0; **A.6**=0; **A.7**=1; **A.8**=1.
4. Skip D/A calibration and save the above settings by selecting **STORE**.
5. Access the function menu and select function 85.
6. The display shows `C 00000`. Enter 65535.
7. Press **PRINT** () to output the value displayed.
8. Use a voltmeter to measure the voltage at pins 2 (+) and 3 (-) of the analogue output connector (J4). Multiply the value by 0.01. This is the *full scale voltage*.
9. Exit Fn 85 and re-enter the **A-CAL** menu.
10. Set parameter **A.1** to 1. The calibration dialog starts.
11. When prompted for `D/A Zero`, enter 00.000.
12. When prompted for `D/A Span`, enter the *full scale voltage* you calculated in step 8.
13. When you finish stepping through the dialog, exit the **A-CAL** menu.
14. Select **STORE** to save your settings.

7.5 Using the Tilt Switch

You can set the time delay for the tilt switch function using the setup parameter **4.t**. Use this parameter to enter the time delay for display lock in 1/10 seconds. The delay may be between 1 and 90 1/10 seconds (i.e. between 0.1 and 9 seconds).

When the contacts close, the display locks after the time delay elapses. When they open again, the display unlocks after the same time delay elapses.

Set **4.t** to `00` to disable the tilt-switch function.

7.5.1 Tilt Switch Options

Parameter **4.t**, which controls the tilt switched, allows several special options, accessed by setting it above `90`:

- `91` – Tare scale on the rising edge of input. Setpoints always enabled.
- `92` – Print on the rising edge of the input. Setpoints always enabled.
- `93` – Setpoints active when input is high. Setpoints inactive when input is low.
- `94` – Scale is tared at the rising edge of input. If taring is successful, setpoints are activated. If input is low, setpoints are inactive.
- `95` – When input is low, scale 1 is selected and displayed. When input is high, scale 2 is selected and displayed.
- `96` – Scale is reset to zero.

8 Service Operations and Testing

8.1 Service Operations

The operations described below are performed by accessing the function menu. For more detailed information on using the function menu, see section 3.3.1.

8.1.1 Setting and Changing Calibration Password (Function 40)

The Personal Identification Number (PIN) restricts access to the calibration procedure. By default, the PIN is inactive and set to `000000`. You can use the procedure below to set a secret PIN, which will prevent users and unauthorized personnel from changing calibration parameters.

➔ **To change the PIN:**

1. Access the function menu and select function 40.
2. The display shows `Pin 0` briefly, and then `000000`. Enter the old PIN and press **PRINT**(🖨).
   - If the PIN you entered is correct, the display shows `PIN 1`.
   - If you entered a wrong PIN, the unit resets. Turn it on and go back to step 1.
3. Enter the new PIN number and press **PRINT**(🖨). The display shows `PIN 2`.
4. Re-enter the new PIN number and press ENTER.

The new PIN is stored and the display shows `PASS` briefly. If the two entries are not the same, `FAIL` is displayed briefly and the new PIN you entered is discarded.

IMPORTANT: Make sure you do not forget the PIN entered. If the PIN is lost, the unit must be returned to the factory to initialize the PIN and a fee will be charged.

8.1.2 Checking Calibration Seal (Function 48)

From time to time, it is advised to check that calibration has not been tampered with. This can be verified by means of the audit trail counter, which increments each time calibration parameters are changed, and by means of a jumper (for more information, see section 4.4). Use the procedure below to see the current value of the counter and the current position of the jumper.

➔ **To check calibration seal and audit trail counter:**

1. Access the function menu and select function 48.
2. The display shows the audit trail counter. Check to see that this counter is the same as it was after the last authorized calibration. Press **PRINT** ().
3. The display shows the status of the physical calibration seal. Press **ESC** () to exit.

8.1.3 Viewing Load Cell mV (Function 80)

➔ **To view an mV meter:**

Access the function menu and select function 80. The indicator loads calibration data, and displays the mV transmitted by the load cell.

8.1.4 Viewing A/D Count (Function 81)

➔ **To view the A/D count:**

Access the function menu and select function 81. The indicator shows the internal count of the analog-to-digital converter. Press **ESC** () to exit.

8.1.5 View Software Version Number and Date (Function 82)

➔ **To view the number and date of the current software version:**

Access the function menu and select function 82. The indicator shows software version number and the date it was released. Press **ESC** () to exit.

8.1.6 Locking and Unlocking Keys

➔ **To lock keys:**

1. Access the setup menus and navigate to **SETUP** > **SETUP 1**.
2. Set one or more of the following parameters to 1:
   - 1.3 – **ZERO**.
   - 1.4 – **TARE**.
   - 1.5 – **P.TARE**.
   - 1.6 – **PRINT**.
   - 1.7 – **TOTAL**.
   - 1.8 – **FUNCTION**.

   Keys you lock will not work (i.e. if a user presses them nothing will happen) until you unlock them.

➔ **To unlock keys:**

1. Access the setup menus and navigate to **SETUP** > **SETUP 1**.
2. Set the corresponding parameter to 0 (see the bulleted list above).

8.2 Testing the Indicator

8.2.1 Testing ROM/RAM Integrity (Function 86)

From time to time, it is advised to check the integrity of the unit's ROM and RAM using the procedure below.

➔ **To test ROM/RAM integrity:**

1. Access the function menu and select function 86.
2. One of the following messages are displayed:
   - `Err 01` – indicates that ROM data is corrupted.
   - `Err 02` – indicates that RAM data is corrupted.
   - `PASS` – indicates that both ROM and RAM memory is okay.

8.2.2 Testing the Keypad and Display (Function 90, 91)

➔ **To test that the display is working properly:**

Access the function menu and select function 90. All digits display 0 through 9, in sequence, and then all characters are displayed in sequence.

➔ **To test that the keypad is working properly:**

Access the function menu and select function 91. The display blanks. When you press a key, the scan code for that key is shown on the display. The scan codes are as follows:

- 32 – **TARE**.
- 33 – **P.TARE**.
- 34 – **PRINT**.
- 35 – **TOTAL**.
- 36 – **FUNCTION**.

8.2.3 Testing Digital Input and Outputs (Function 93)

➔ **To test digital input and outputs (setpoints):**

1. Access the function menu and select function 93.
2. The display shows the status of the inputs and outputs, as follows:
   - The first digit from the left displays data received on the digital input channel.
   - The fifth digit from the left displays data sent on output 1.
   - The sixth digit from the left displays data on output 2.
3. Press **PRINT** () to toggle output 1 on and off. When it is on, the data sent should be displayed in the fifth digit. If the output connects to another device, check if the signal was received.
4. Press **TOTAL** () to toggle output 2 on and off. When it is on, the data sent should be displayed in the sixth digit. If the output connects to another device, check if the signal was received.
5. Connect a device to the digital input, and send a signal. See if the data appears in the first digit.

8.2.4 Testing the Print Buffer (Function 94)

➔ **To test the print buffer:**

Access the function menu and select function 94. An ASCII file (30h-7Fh) is output to the printer port, with error control.

8.2.5 Testing Data Received on Both Serial Ports (Function 96)

➔ **To test data received on one or both serial ports:**

1. Access the function menu and select function 96.
2. The display shows data received on COM ports, as follows:
   - The two digits on the left (first and second digits) show data received on COM 1.
   - The two digits on the right (fifth and sixth digits) show data received on COM 2.
3. Connect a PC or another device to one or both of the indicator's ports, and begin transmitting data. Watch the display to see if the data is received properly.

9 Troubleshooting

The indicator has no serviceable parts. Authorized technicians may:

- Respond to errors shown on the display (see section 9.1).
- Check load cell connections (see section 9.2).
- Check the power supply (see section 9.3).
- Check the digital input and outputs (see section 9.4).

9.1 Errors, Causes and Remedies

When an error or an unexpected event occurs, the indicator displays the message `Err xx`, where xx is the error code. The following table explains all the error codes and suggests what to do when each error message is displayed.

Error code	Possible cause	Actions to be taken
Err 01	Faulty EPROM memory.	Contact manufacturer.
Err 02	Faulty CMOS RAM.	Contact manufacturer.
Err 04	Calibration data corrupted due to faulty EEPROM.	Contact manufacturer.
Err 05	The scale is not connected properly, or the analog-to-digital converter is faulty.	Check the scale, cable and connectors. If these are okay, contact manufacturer.
Err 06	Insufficient power.	Check the indicator's power supply.
Err 07	Data memory is corrupted, either because of extreme power supply transient or because the totalizer has not been cleared.	Input all operational data and clear totalizer.
Err 15	The indicator has been powered on after an irregular shutdown: A power failure or a soft reset.	Press **ZERO** ().
Err 20	The printer is not online because it is not connected, not turned on, out of paper, or for some other reason.	Make sure the printer is connected and operational, and press **PRINT** () to retry. If you can't bring the printer online, and you would like to use the indicator anyway, press **ZERO** ().

Error code	Possible cause	Actions to be taken
Err 26	Printer has no paper.	Add paper to the printer, and press **PRINT** () to retry. If you can't add paper, and you would like to use the indicator anyway, press **ZERO** ().
Err 30	The host PC is not connected, or the communication link failed.	Make sure the computer is connected, and press **PRINT** () to retry. If there is some problem with the computer, but you would like to use the indicator anyway, press **ZERO** ().
Err 33	The host PC did not return a proper response (an acknowledgement required by the communication protocol).	Make sure the computer is connected, and press **PRINT** () to retry. If there is some problem with the computer, but you would like to continue using the indicator anyway, press **ZERO** ().
Err 55	Alibi memory is full. The memory serial number resets to 0000. From now on, each new memory entry overwrites the oldest record in alibi memory.	Press **ZERO** ().
Err 56	Printing error. Tare is currently active, but selected print format does not support net weight.	Printout aborted. Printing stops and returns to weighing mode.
Err 57	The weight measurement could not be saved to alibi memory.	Press **ZERO** ().
Err 67	The area of memory that stores the accumulated total weight is corrupted.	Print/reset the total weight
Err 69	The area of memory that stores the accumulated total weight has overflowed. In other words, the total weight is too large.	Print/reset the total weight

9.2 Checking Load Cell Connection

If there appears to be a problem with the load cell connection:

- Check input and output resistance.
- Check resistance between any terminal and shield.
- Check load cell connection and cable.

9.3 Checking Power Supply

If the unit does not turn on:

- Check 24VDC power supply.
- Check the resettable fuse F3 on PCB 801.

9.4 Checking Digital Input and Outputs

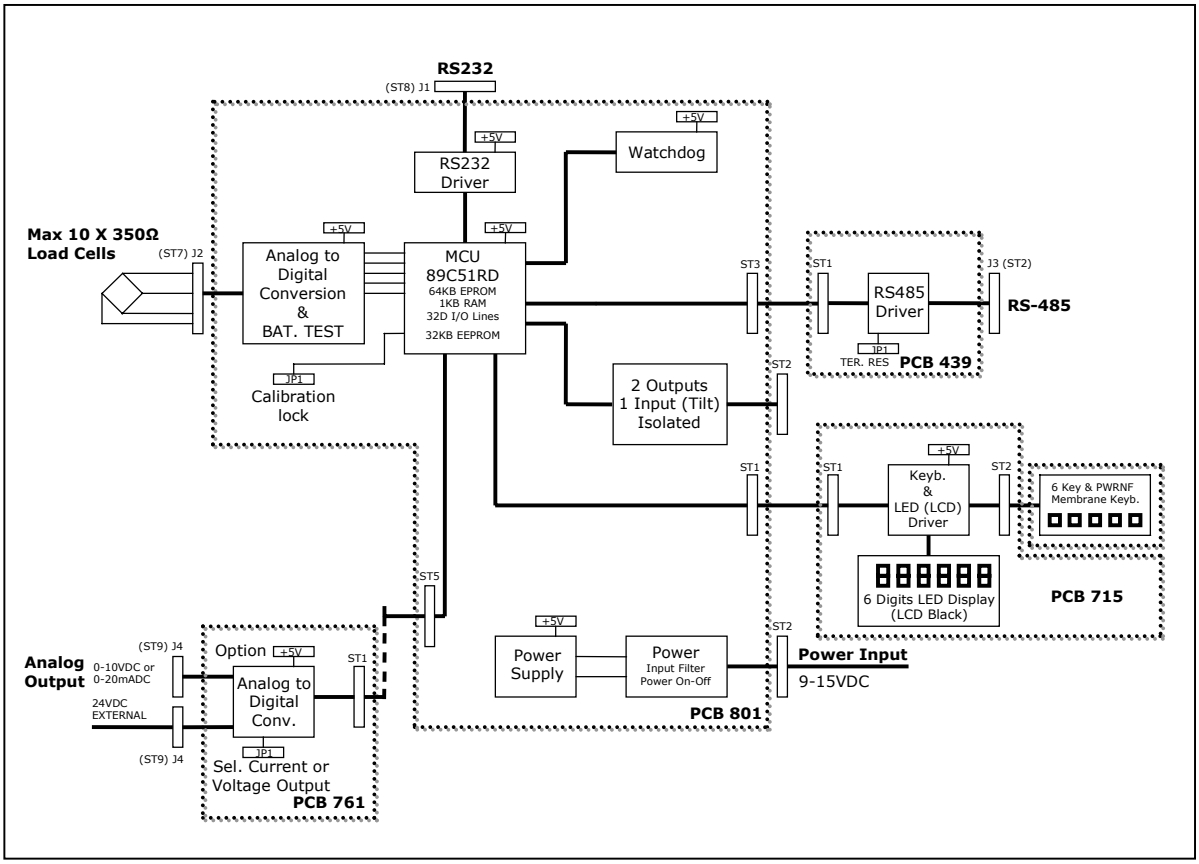
If the setpoints are not working properly, you can test them using the instructions below.

➔ **To test digital input and outputs (setpoints):**

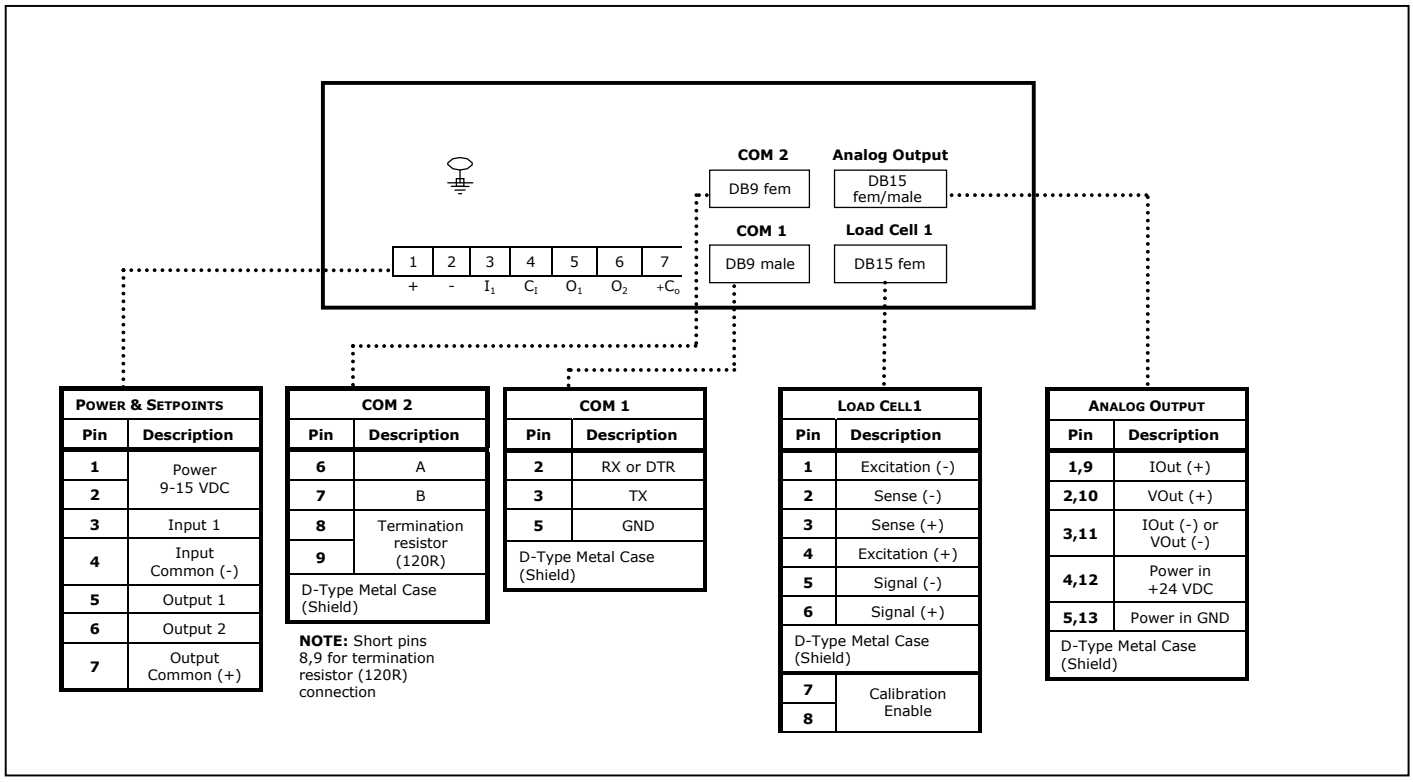
1. Access the function menu and select function 93.
2. The display shows the status of the inputs and outputs, as follows:
   - The first digit from the left displays data received on the digital input channel.
   - The fifth digit from the left displays data sent on output 1.
   - The sixth digit from the left displays data on output 2.
3. Press **PRINT** () to toggle output 1 on and off. When it is on, the data sent should be displayed in the fifth digit. If the output connects to another device, check if the signal was received.
4. Press **TOTAL** () to toggle output 2 on and off. When it is on, the data sent should be displayed in the sixth digit. If the output connects to another device, check if the signal was received.
5. Connect a device to the digital input, and send a signal. See if the data appears in the first digit.

Appendix A: Technical Drawings

i. System Block Diagram



ii. Rear Panel Connections (Desktop Model)



POWER & SETPOINTS	
Pin	**Description**
1	Power 9-15 VDC
2	
3	Input 1
4	Input Common (-)
5	Output 1
6	Output 2
7	Output Common (+)

COM 2	
Pin	**Description**
6	A
7	B
8	Termination resistor (120R)
9	
D-Type Metal Case (Shield)	

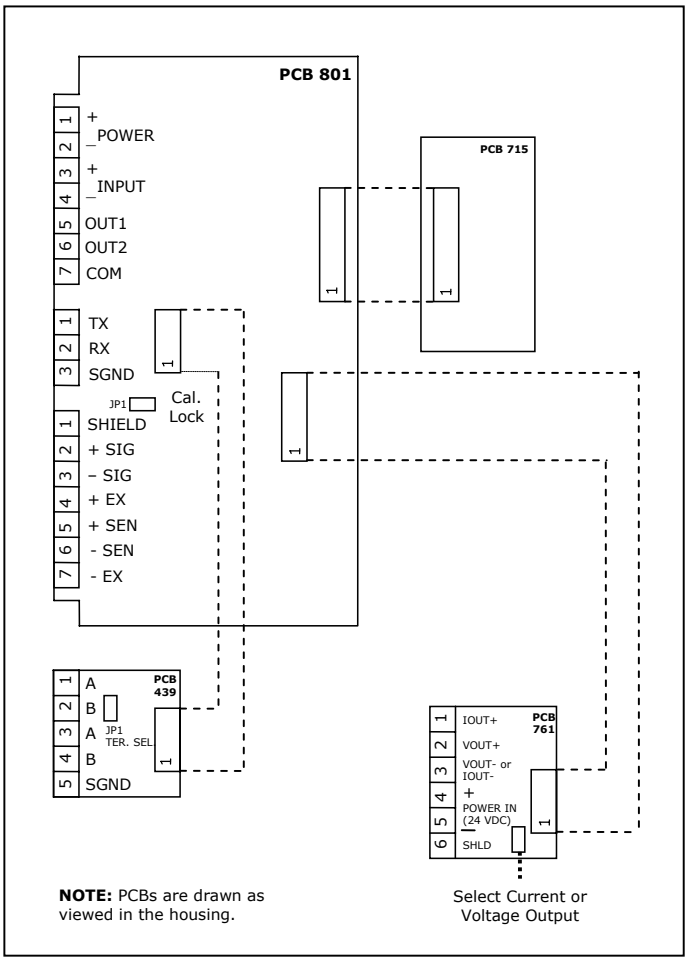
NOTE: Short pins 8,9 for termination resistor (120R) connection

COM 1	
Pin	**Description**
2	RX or DTR
3	TX
5	GND
D-Type Metal Case (Shield)	

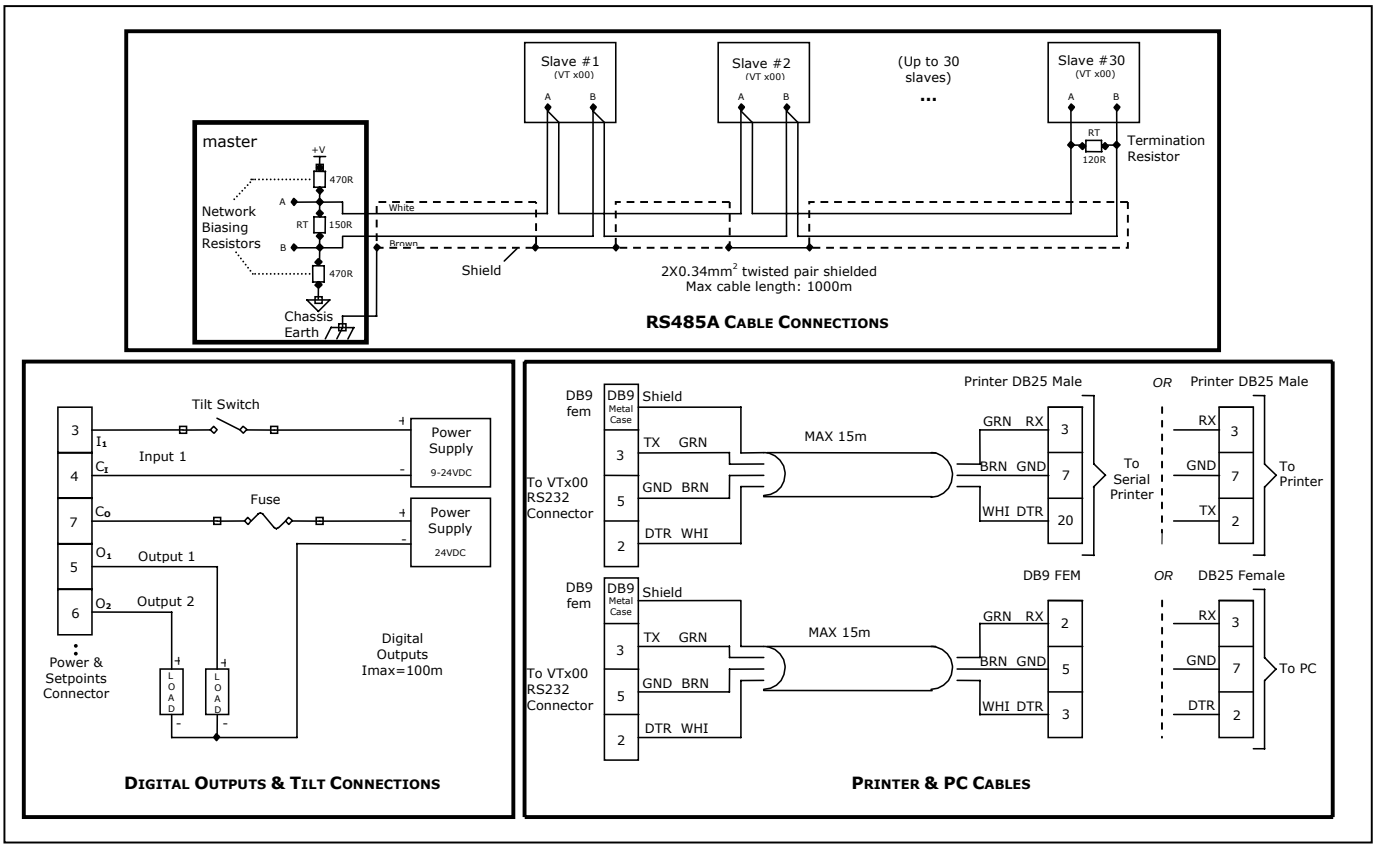
LOAD CELL1	
Pin	**Description**
1	Excitation (-)
2	Sense (-)
3	Sense (+)
4	Excitation (+)
5	Signal (-)
6	Signal (+)
D-Type Metal Case (Shield)	
7	Calibration Enable
8	

ANALOG OUTPUT	
Pin	**Description**
1,9	IOut (+)
2,10	VOut (+)
3,11	IOut (-) or VOut (-)
4,12	Power in +24 VDC
5,13	Power in GND
D-Type Metal Case (Shield)	

iii. Terminal Connections (Wall-Mount Model)



iv. Cabling Diagram



Appendix B: Master-Slave Protocol

Appendix Contents

i. Introduction

This appendix defines the communication between a host computer (the *master*) and a maximum of 5 weighing terminals (the *slaves*). The host computer may be any processor connected to an asynchronous serial port: for example, a personal computer or a mini computer. Each slave in the network possesses a unique address, in ASCII characters A to Z. The *Master-Slave Commands* enable remote monitoring and/or operation of the weighing terminals by the host processor.

The Master always controls the communication link although the Master itself may at the same time be a slave to a higher level network. The master polls the slave machines and they respond within a specific time period.

The protocol is designed as a low-cost long-distance communication link, to support sporadic data exchanges in industrial environments, for network multi-drop applications. Network connections require twisted-pair shielded cables and support a 20mA current loop standard and the RS485 standard.

ii. Baud Rate and Message Format

600-9600 baud,
1 start bit, 7 data bits, 1 even parity bit, and 1 stop bit.

6 data bits are used for the communication; The 7th data bit serves as the start-of-message delimiter in the address byte.

iii. Data Block Format

All communication is performed using nine-byte messages with a standard format:

ID SLAVE	COMMAND	DATA	BCS

Message Components

Name	Length (bytes)	Hex Code	Description
ID Slave	1	41h - 5Ah	Slave identification character (A-Z, or @ for command to be executed by all units on the network.
Command	1	20h - 3Fh	Command type.
Data	6	x	The data associated with the command, or data from slave. If no data is associated with the command send 6 space characters (20h).
BCS	1	x	Block checksum. The XORSUM of the six LSB of all bytes. Two most significant bits are always set to zero: 0 x x x x x

iv. Communication Process Overview

The main type of master-slave communication between the host and the VT400 processor is when the master addresses a slave unit with a request for information, and the slave responds by transmitting the data requested by the master.

Master Transmission

A communication session is started when the master processor transmits a command to a slave. In most cases the slave does not respond immediately. The master scans for status with a **Status** (?) command. If the slave is ready to respond, then – depending on the initial command – the slave responds either by sending data or by echoing the data received. If status data is ready, the slave will begin transmitting to the master with a three-msec delay. If the master does not receive a response within the appropriate interval the scan is rejected: for example, in the case of auto self-calibration, which occurs regularly when the scale is stable. This reduces unnecessary wait time of the master during polling.

Response time to a command varies and depends on the execution time of the command. Multiple scans may be needed until the response is received. The communication session is ended either when a response arrives or when the timeout period has passed.

Slave Response

All slaves on the network receive all data transmitted by the master but they respond only to the data blocks with the appropriate slave address. For some commands the slave does not respond after the execution. When it receives an unknown command, it responds with a Non-Acknowledge (NACK) block.

The slave typically begins transmitting the response string within a one-character duration from the end of the master's transmission. If an error has occurred in the master's transmission (for example: parity, overrun, framing, or checksum errors), the slave does not respond.

In case of communication error the master waits in idle transmission state for a ten-character duration to allow for the slave's transmit buffers to be cleared. The master can initialize the slave's receiver buffers by transmitting a 7Fh.

Communication Modes

Two modes of communication can be used for 20mA current loop :full duplex and half duplex. For RS485, only half-duplex mode can be used.

v. Master-Slave Commands

Following is a summary of the commands available in the master-slave protocol. After the table is a more detailed description of each command.

Operational Command	Hex	Description	Time	Slave Response
?	3F	Upload weight and status	Char duration	Status + weight
0	30	Reset Slave	-	None
1	31	Upload Tare	0.2 sec	Data
2	32	Keyboard Emulation	0.2 sec	Echo
3	33	Download Setpoint Values	0.2 sec	Echo
4	34	Upload Setpoint Values	0.2 sec	Data
5	35	Read Setpoint Values	0.2 sec	Data
6	36	Force Setpoint Outputs	0.2 sec	Echo
7	37	Enable Setpoint Outputs	0.2 sec	Echo
8	38	Upload Error Code	0.2 sec	Data
;	3B	Download Function	0.2 sec	Echo

? Command: Upload Status

This is the main command used to poll the slave or slaves. The slave replies with the current weight being measured, or with a message if bit 0 of the status byte is '1'.

Master Transmission	<table><tr><td>ID SLAVE</td><td>?</td><td>XXXXXX</td><td>BCS</td></tr></table> XXXXXX: These bytes are not used; fill with Space character (20h). For RS485, Master Transmission contains only ID Slave, ? and BCS.
Slave Response	<table><tr><td>ID SLAVE</td><td>Weight Status</td><td>Weight Digits</td><td>BCS</td></tr></table> Weight Status Byte: see table below. Weight Digits: 6 bytes (ASCII), including decimal point. Most significant byte first.

Weight Status Byte:

B7	B6	B5	B4	B3	B2	B1	B0
0	1	1	Under/over range	Sign	No motion	Error Status	Mode
			0=UNDER, 1=OVER	0= + 1= -	0=NO, 1=YES	0=NO, 1=YES	0=Gross, 1=Net

0 Command: Reset Slave

Resets the slave to its power-on condition.

Master Transmission	<table><tr><td>ID SLAVE</td><td>0</td><td>XXXXXX</td><td>BCS</td></tr></table> XXXXXX: These bytes are not used; fill with Space character (20h).
Slave Response	None

1 Command: Upload Tare

This command is used, when the scale is tared, to upload the tare value.

Master Transmission	<table><tr><td>ID SLAVE</td><td>1</td><td>XXXXXX</td><td>BCS</td></tr></table> XXXXXX: These bytes not used; fill with Space character (20h).
Slave Response	<table><tr><td>ID SLAVE</td><td>1</td><td>Tare Weight</td><td>BCS</td></tr></table> Tare Weight: 6 bytes (ASCII), including decimal point. Most significant byte first.

2 Command: Keyboard Emulation

This command performs the operation corresponding to pressing one of a set of keys on the keypad. **SETUP3** parameter **3.5** must be set to 1 (Keyboard Commands enabled) before this command can be used.

Master Transmission	<table><tr><td>ID SLAVE</td><td>2</td><td>0CXXXX</td><td>BCS</td></tr></table> 0: ASCII (30h) C (the opcode of the key): 1 (31h) [>0<key] 2 (32h) [Tare key] 3 (33h) [P.Tare key] 4 (34h) [Print key] 5 (35h) [ast (total) key] 6 (36h) [fn key] XXXX: These bytes are not used; fill with Space character (20h).
Slave Response	ECHO

3 Command: Download Setpoint Values

This command downloads setpoint values from the master and saves them in the slave's memory.

Master Transmission	<table><tr><td>ID SLAVE</td><td>3</td><td>NYYYYY</td><td>BCS</td></tr></table> N: Setpoint number 1-2 (ASCII) YYYYY: Setpoint value (ASCII, MSB first)
Slave Response	ECHO

4 Command: Upload Setpoint Values

This command uploads setpoint values from the slave to the master.

Master Transmission	<table><tr><td>ID SLAVE</td><td>4</td><td>NXXXXX</td><td>BCS</td></tr></table> N: Setpoint number 1-2 (ASCII) XXXXX: These bytes are not used; fill with Space character (20h).
Slave Response	<table><tr><td>ID SLAVE</td><td>4</td><td>NYYYYY</td><td>BCS</td></tr></table> N: Setpoint number 1-2 (ASCII) YYYY: Setpoint value (ASCII, MSB first)

5 Command: Read Setpoint Values

This command uploads status for the setpoint outputs.

Master Transmission	<table><tr><td>ID SLAVE</td><td>5</td><td>XXXXXX</td><td>BCS</td></tr></table> XXXXXX: These bytes are not used; fill with Space character (20h).
Slave Response	<table><tr><td>ID SLAVE</td><td>5</td><td>12----</td><td>BCS</td></tr></table> 1,2: Status of setpoints 1 and 2: 0 if setpoint is off, 1 if setpoint is on) ----: Space characters (20h)

6 Command: Force Setpoint Outputs

This command sets or cancels setpoints but does not activate them. After this command is issued the setpoints can be activated using the Enable Setpoint Outputs command (see below).

Master Transmission	<table><tr><td>ID SLAVE</td><td>6</td><td>12----</td><td>BCS</td></tr></table> 1,2: Status of setpoints 1 and 2: 0 turns setpoint off, 1 turns setpoint on)
Slave Response	ECHO

7 Command: Enable Setpoint Outputs

This command is typically used after a Force Setpoint Output command (see above) and it used to activate setpoints using the current settings in the slave memory.

Master Transmission	<table><tr><td>ID SLAVE</td><td>7</td><td>XXXXXX</td><td>BCS</td></tr></table> XXXXXX: These bytes are not used; fill with Space character (20h).
Slave Response	ECHO

8 Command: Upload Error Code

This command uploads an error code when an error associated with status byte, upload weight or status command is detected. Error codes are listed in 9.1.

Master Transmission	<table><tr><td>ID SLAVE</td><td>8</td><td>XXXXXX</td><td>BCS</td></tr></table> XXXXXX: These bytes not used; fill with Space character (20h).
Slave Response	<table><tr><td>ID SLAVE</td><td>8</td><td>EE----</td><td>BCS</td></tr></table> EE: Error code (ASCII) ----: Space characters (20h)

; Command: Download Function

This command executes the specified function.

Master Transmission	<table><tr><td>ID SLAVE</td><td>; (3Bh)</td><td>NNXXXX</td><td>BCS</td></tr></table> NN: Function number (ASCII DEC) XXXX: These bytes not used; fill with Space character (20h).
Slave Response	ECHO

Setup Commands

These commands download parameters from a host, for setup and calibration of the VT400. Refer to Section 3.4.3 for details on these parameters. See the end of this section for information on uploading setups from a slave device to the host machine.

The following is the format of most setup commands:

ID SLAVE	COMMAND	W1 (2 bytes)	W2 (2 bytes)	W3 (2 bytes)	BCS

Data word (W1-W3) format :

Most significant byte (b7 to b4: nibble)

0	0	1	1	b7	b6	b5	b4

Least significant byte (b3 to b0: nibble)

0	0	1	1	b3	b2	b1	b0

Decimal to ASCII-hex Conversion:

Most of the setup commands have a data parameter which is specified in ASCII hex and produces a decimal equivalent for the VT400 setup.

➔ **To convert from a decimal value to the ASCII hex equivalent:**

1. Convert the value from decimal to hex: for example, `90 (dec)` to `5A (hex)`.
2. Replace any letters `(A-F)` in the hex value with an ASCII character according to the following conversion pairs (for example, `5A` in hex to `5:` in ASCII hex.
   - A (hex) to :
   - B (hex) to ;
   - C (hex) to <
   - D (hex) to =
   - E (hex) to >
   - F (hex) to ?

Setup Command Slave Response

The slave response to a setup command is an ECHO of the command, and the response can be further verified using the Status (?) command.

Setup Commands Summary

Setup Command	Hex	Description	Slave Response
"	22	Download Parameters (1)	Echo
(Space)	20	Upload Parameters (1)	Data
#	23	Download Parameters (2)	Echo
!	21	Upload Parameters (2)	Data
$	24	Download D/A Setup and Zero	Echo
+	2B	Upload D/A Setup and Zero	Data
%	25	Download D/A Full	Echo
,	2C	Upload D/A Full	Data
&	26	Download Setup 1,2,3	Echo
-	2D	Upload Setup 1,2,3	Data
`	27	Download Setup 4,5	Echo
.	2E	Upload Setup 4,5	Data
)	29	Download Serial Port 2 Configuration	Echo
:	3A	Upload Serial Port 2 Configuration	Data
*	2A	Write to EEPROM	None

" and (space) Commands: Download/Upload Parameters (1)

New settings do not go into effect until a Write to EEPROM (*) command is issued.

Data Byte Number	Parameter to be Set	Name	Description
W1	4.P	First two digits of weighing range	ASCII hex
W2	6.P	Conversions per second	ASCII hex
W3	Bit 8.1 Bit 8.2 Bit 8.3 Bit 8.4 Bit 8.5 Bit 8.6 Bit 8.7 Bit 8.8	b0 b1 b2 b3 b4 b5 b6 b7	

and ! Commands: Download/Upload Parameters (2)

New settings do not go into effect until a Write to EEPROM (*) command is issued.

Data Byte Number	Parameter to be Set	Name	Description
W1	0.P	Dual interval	ASCII hex
W2	2.P (b7-b5)	Decimal digits	000=0, 001=1, 010=2, 011=3, 100=4.
	1.P (b4)	Number of display digits	0=4 digits 1=5 digits
	3.P (b3-b0)	Display resolution	0000 = 1 0001 = 2 0010 = 5 0011 = 10 0100 = 20 0101 = 50 0110 = 100 0111 = 200
W3	5.P (b7-b4)	Digital filter	0000=min to 0101=max
	7.P (b3-b0)	Number of motion samples	0000=min to 0110=max

$ and + Commands: Download/Upload D/A Setup and Zero (1)

New settings do not go into effect until a Write to EEPROM (*) command is issued.

Data Byte Number	Parameter to be Set	Name	Description
W1	A.1-A.8 (b0-b7)	A.1 A.2 A.3 A.4 A.5 A.6 A.7 A.8	b0 b1 b2 b3 b4 b5 b6 b7
W2	-	Analog output 0	2 most significant digits, ASCII hex (no decimal point)
W3	-	Analog output 0	2 least significant digits, ASCII hex (no decimal point)

% and , Commands: Download/Upload D/A Full (1)

New settings do not go into effect until a Write to EEPROM (*) command is issued.

Data Byte Number	Parameter to be Set	Name	Description
W1	2, 2L	Linefeeds after printout	2 digits (ASCII) hex
W2	-	Analog output FULL	2 most significant digits, ASCII hex (no decimal point)
W3	-	Analog output FULL	2 least significant digits, ASCII hex (no decimal point)

& and - Commands: Download/Upload Setup 1, 2, 3

Data Byte Number	Parameter to be Set	Parameter Bit	Command Word Bit
W1	SETUP 1	1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8	b0 b1 b2 b3 b4 b5 b6 b7
W2	SETUP 2	2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8	b0 b1 b2 b3 b4 b5 b6 b7
W3	SETUP 3	3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8	b0 b1 b2 b3 b4 b5 b6 b7

` and . Commands: Download/Upload Setup 4,5

Data Byte Number	Parameter to be Set	Parameter Bit	Command Word Bit
W1	SETUP 4	4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8	b0 b1 b2 b3 b4 b5 b6 b7

Data Byte Number	Parameter to be Set	Parameter Bit	Command Word Bit
W2	SETUP 5	5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8	b0 b1 b2 b3 b4 b5 b6 b7
W3	Additional PAR bits: 8.9, 8.A, 8.b	8.9 8.A 8.b	b0 b1 b2

) and : Commands: Download/Upload Serial Port 2 Configuration

New settings of baud rate and data bits do not go into effect until a Write to EEPROM (*) command is issued.

Data Byte Number	Parameter to be Set	Name	Description
W1	3.t	Slave address	ASCII hex
W2	2.b	Baud rate	ASCII hex
W3	2.d	Data bits	ASCII hex

* Command: Write to EEPROM

This command records the setup and calibration data sent to the VT400 via the other setup commands in this section, and resets the indicator. No ACK block is transmitted in this communication.

Data Byte Number	Parameter to be Set	Name	Description
W1	-	-	Not used.
W2	-	-	Not used.
W3	-	-	Not used.

Upload of Setup Parameters: Message Formats

Master Transmission

ID SLAVE	COMMAND	XXXXXX	BCS

XXXXXX: These bytes not used; fill with Space character (20h).

Slave Response

ID SLAVE	COMMAND	W1 (2 bytes)	W2 (2 bytes)	W3 (2 bytes)	BCS

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