GB

VTDJB

TECHNICAL MANUAL

VISHAY PRECISION GROUP

TABLE OF CONTENTS

1 INTRODUCTION

The VTDJB is a junction board for connection of up to 4 analogue load cells. It contains all transducer electronics to excite the strain gauges, amplify, filter and convert the analogue signal of each load cell to a digital form. The outputs from each load cell are corner corrected and summed to form the scale weight output. If one load cell is connected only it should be connected to LC #1 input, two load cells to inputs #1 and #2 etc.

The weight is output in digital form via an RS485A serial interface or in analogue form via a 0/4 – 20mA optional interface. The RS485 interface may be used in multi-drop applications where each VTDJB has its own unique address.

All weighing functions necessary for operation of weighing system such as Zero, Tare, No motion detection, error monitoring are performed by the VTDJB.

An ASCII standard serial interface command set allows VTDJB to be connected with personal computers, PLCs, intelligent peripherals, etc.

The calibration of each corner and of the scale is handled by the VTDJB through a calibration sequence initiated via the serial interface. Calibration constants are stored in EEPROM on board. Calibration security is effected by a CALLOCK hardware inside the VTDJB which may be sealed and a PINLOCK software device that once activated inhibits access to calibration constants if the PIN code is not entered. The unit is also provided with an Audit Trail Counter which is incremented every time the calibration parameters and/or constants are modified.

The weight data rate is setup selectable to cater for high accuracy static weighing (2-5 conversions/sec) or medium accuracy dynamic weighing (10-20-40 conversions/sec) applications with computers or other systems.

The unit has been designed for use in industrial environments and is EMC compliant to EN 45501 standards.

The VTDJB has two optoisolated setpoint outputs and one optoisolated input.

A potential free Tilt switch may be connected to inhibit weighing while the scale is not level.

OPTIONS

OP.1 Analogue output 20mA (optoisolated).
OP.2 Automatic Tilt correction device (Bi-directional).
OP.3 N/A
OP.4 Stainless steel housing 200 x 105 x 45 mm with cable glands or DB9F connector.
OP.5 Mains power adapter 230 VAC to 9 VAC/ 500mA.
OP.6 Remote Display Terminal VT150.
OP.7 RS232C/RS485A converter including power adapter 230VAC to 9VAC/500mA.

2 HARDWARE DESCRIPTION – INSTALLATION

Normally VTDJB comes in a sealed stainless steel enclosure, suitable for wash-down environment. Entry of connecting cable is through sealed cable glands. Refer to Annex A for details of the enclosure and main PCB 703.2. In addition an analogue output (PCB 760) and a tilt switch may be connected.

2.1 Mounting

The mounting location should be such that the unit is not subject to excessive vibrations or heat.
The top panel should be accessible.

2.2 Wiring

Remove the lid by undoing the four screws.
Insert cables via the cable glands. Strip the cables and connect the load cells 1 to 4 to connectors ST6 to ST9 respectively. If the load cell cables are 6-wires connect together the excitation and sense leads or cut off the sense leads.
Connect the shields of the cables on SHLD terminal or directly on the chassis screws using eyelet terminals.
Power cable is connected to connector ST1.
Connect serial communication cable to connector ST2 according to the drawing in appendix A, paragraph 11.2 PCB 703.2.
When wiring is completed pull out any excessive cable and tighten the cable glands to ensure a firm grip on the cables. Re – install the lid and tighten the screws until the side edges are recessed 2 mm from the lid edges.
FOR OPTIMUM EMC PERFORMANCE KEEP THE LENGTH OF THE SHIELD INSIDE THE ENCLOSURE AS SHORT AS POSSIBLE.

2.3 Power

As the instrument is computer controlled it requires clean power for reliable operation.
Power supply should come from a source that is isolated from other process equipment.
A mains adapter of 7.5 – 10VAC/500 mA is recommended.
Connect a power supply 7 - 10 VAC or 7.5 - 12 VDC (150mA min.) to ST1 (polarity independent).

2.4 Analogue output (option)

Connect to ST2 of analogue output PCB760 according to the drawing in appendix A paragraph 11.2.

2.5 Setpoint outputs

Connect isolated input/output to ST5 (if used) according to the drawing in appendix A paragraph 11.2 PCB 703.2

2.6 Tilt switch

Connect a dry contact to Pins 1 & 2 of ST3.
The tilt switch wires must be contained in the power and communications cable.
N.O or N.C contact and debounce timer are set in SETUP 1.

CAUTION : ***Do not run signal cables together with power cables.***
Connect the shielding where indicated on the drawing only.
Never use a megger to check wiring.

3 FUNCTIONAL DESCRIPTION

All VTDJB operations are performed via the serial interface, through the use of a Master/Slave serial interface protocol. The file type's specific to VTDJB will be described here. The VTDJB is always a slave. Several VTDJBs may be connected in a network microprocessor controlled device.
The communication buffer size is 13 bytes max for Transmitter and Receiver (Half duplex).
Detailed description of the file types and sequences is given in the following pages.

LIST OF FILE TYPES (COMMANDS)

TYPE		HEX	DESCRIPTION	TIME	RESPONSE
?		3F	UPLOAD WEIGHT & STATUS	50 ms	STATUS + WEIGHT
A		41	DEADLOAD CAL (ELECTRONIC mV/V)	1.5 sec	Poll slave by using command '?'
	a	61	DEADLOAD CAL (weights)	16 sec	Poll slave by using command '?'
B		42	SPAN CAL (ELECTRONIC, L/C Capacity)	1.5 sec	Poll slave by using command '?'
	b	62	SPAN CAL (weights)	16 sec	Poll slave by using command '?'
C		43	DOWNLOAD mV/V for each corner	0.1 sec	Poll slave by using command '?'
	c	63	CALIBRATE CORNERS	16 sec	Poll slave by using command '?'
	d	64	UPLOAD AUDIT TRAIL CNT,CALLOCK	0.1sec	6 Digit counter, status Callock
	f	66	UPLOAD CORNER FACTORS	0.1 sec	FACTOR 1,2,3 ,4
G		47	GROSS	0.1sec	NONE
H		48	RESERVED		
	i	69	UPLOAD INTERNAL RESOLUTION	0.1 sec	INTERNAL DIVISIONS
J		4A	LOCK / UNLOCK CALIBRATION	0.1sec	6 Digit PIN or NAK
P		50	DOWNLOAD PAR 1/ PAR 2/ PAR 3	0.1 sec	ACK or NAK
	p	70	UPLOAD PAR 1/ PAR 2/ PAR 3	0.1 sec	PAR 1/2/3
Q		51	DOWNLOAD SETPOINT 1 / SETPOINT 2	0.1 sec	ACK or NAK
	q	71	UPLOAD SETPOINT 1 / SETPOINT 2	0.1 sec	SETPOINT 1/ SETPOINT 2
R		52	RESET SLAVE	16 sec	NONE
S		53	DOWNLOAD SETUP: SETUP 1 / SETUP 2	0.1 sec	ACK or NAK
	s	73	UPLOAD SETUP1	0.1sec	Setup1
T		54	TARE	0.1 sec	NONE
W		57	WRITE TO EEPROM	16 sec	NONE
Z		5A	ZERO	3 sec	NONE

FILE TYPE DESCRIPTION

Calibration and weight parameters are protected by calibration lock devices hardware and software.

If the CALIBRATION LOCK is activated, weight parameter/calibration file types are not accessible.

The “CAL LOCK” is a hardware jumper inside the VTDJB required by Weights & Measures authorities so that calibration can be sealed (jumper inserted).

The “PINLOCK” is software Personal Identification Number, which ensures that no accidental scale calibration is attempted. The “PIN LOCK” and the “CAL LOCK” are logically connected.

In addition to the “CAL LOCK” an A.T.CNT (Audit Trail Counter) is provided for use by Weights and Measures Authorities.

The A.T.CNT (6 digits) is incremented when a weight parameter is changed, or a corner/scale calibration is attempted, regardless if the changes are saved in EEPROM or not.

The position of the “CAL LOCK” jumper and the A. T. CNT number may be inspected using command “d”.

The A.T.CNT may be viewed by the Weight & Measures to verify that no calibration constants have been altered since the inspection/stamping date.

To avoid wait time in certain commands, especially when units are connected in a network, the VTDJB will not respond to the command issued but on subsequent polls by command “?”.

CHECKSUM DESCRIPTION

The total checksum (BCS in hex format) is calculated as XOR sum of all character preceding the first checksum character in the message (BCS2).

BCS1 is calculated as: (BCS / 10(h)) + 30 (h)

BCS2 is calculated as: (BCS Mod 10(h)) + 30 (h)

Example

	STX	**ADD**	**?**	**BCS2**	**BCS1**	**ETX**
Hex	02	41	3F	3C	37	3
Ascii	STX	A	?	<	7	ETX

BCS: 02 XOR 41 XOR 3F = 7C (h)

BCS1: (7C / 10) + 30 = 07 + 30 = 37 (h)

BCS2: (7C Mod 10) + 30 = 0C + 30 = 3C (h)

NOTE! All figures in the checksum calculation example are in Hex format.

? UPLOAD STATUS

It is the main command used to poll the VTDJB(s), which reply with the current weight being measured or with a message if bit0 of status byte is '1'. In the normal state the VTDJB will respond within 3-4 character time. (e.g. with 9600baud, the character time ≈ 1 ms, the master should expect reception of STX from the VTDJB within 5 ms after the ETX was transmitted from the master).

Master transmission

STX	ADD	?	BCS2	BCS1	ETX

Slave response

STX	ADD	X	STATUS BYTE	WEIGHT	BCS2	BCS1	ETX

where X= '?' if there is new A/D conversion since the last weight value transmission.
X=' ' if there is no new A/D conversion since the last weight value transmission.
and WEIGHT: 5 digits + decimal point if any (ASCII, MSD FIRST, always 6 characters).

STATUS BYTE

b7	b6	b5	b4	b3	b2	b1	b0
Zero or Parity	1	Sign of weight 0=+ 1=-	No Motion 0=NO, 1=YES	Out of Range 0=NO 1=YES	Autozero 0=NO 1=YES	0=Gross 1=Net	0=Normal Weight 1=No Weight Display

NOTE! The WEIGHT field will contain a message if b0 of the status byte is high.

A . DEAD LOAD CALIBRATION (ELECTRONIC mV/V)

Downloads the total mV/V output of the empty scale for dead load calibration.

Master transmission:

STX	ADD	A	yyyyyy	BCS2	BCS1	ETX

yyyyyy: 6 digits of mV/V multiplied by 10000 (ASCII decimal).
Poll the slave by using command '?'. Possible response messages: 'WAIT..' or 'ERR 91'.
Slave returns to normal Weight output after the command is completed.

THE VALUE IS NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

EXAMPLE: For a 0.1234 mV/V load cell dead load output the data downloaded must be 001234.

Master transmission :

STX	A	A	001234	6	0	ETX

Master transmission:

STX	A	?	<	7	ETX

Slave response:

STX	A	?	A	WAIT..	6	3	ETX

a. DEAD LOAD CALIBRATION (WEIGHT)

When this command is received the VTDJB will measure the weight of the empty scale by averaging 32 conversions. This DEAD LOAD average will be held in the ZERO CALIBRATION memory.

Master transmission:

STX	ADD	a	BCS2	BCS1	ETX

Poll the slave by using command '?'. Possible response messages: 'WAIT..' or 'ERR 91'
Slave returns to normal weight output mode after the command is completed.
THE VALUE IS NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

B. SPAN CALIBRATION (ELECTRONIC)

Used to download the capacity of ONE load cell for SPAN factor computation.
The command must be preceded by command "C".

Master transmission:

STX	ADD	B	yyyyy	BCS2	BCS1	ETX

yyyyy: 5 digits without decimal point (ASCII decimal)
Poll the slave with command '?'. Possible responses: "WAIT.." or "ERR 90" or "ERR 91".
Slave returns to normal weight output mode after the command is completed.
THE VALUE IS NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

b. SPAN CALIBRATION (WEIGHTS)

Used to download the known WEIGHT already placed on the scale for Span factor computation.

Master transmission:

STX	ADD	b	yyyyy	BCS2	BCS1	ETX

yyyyy: 5 digits without decimal point (ASCII decimal)
Poll the slave with command '?'. Possible responses: "WAIT.." or "ERR 90" or "ERR 91".
Slave returns to normal weight output mode after the command is completed.
THE VALUE IS NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

C. DOWNLOAD mV/V OF EACH CORNER

Used to download mV/V output at rated capacity of each load cell. The load cells must be of the same rated capacity. The VTDJB will expect the data for the number of load cells stated in P1 command.

Master transmission:

STX	ADD	C	1	yyyyyy	BCS2	BCS1	ETX

yyyyyy : 6 digits (ASCII decimal) of rated mV/V multiplied by 10000 for CORNER 1.
Poll the slave by using command '?'. Possible response messages: "ERR 91" or "CORN.2"

Master transmission:

STX	ADD	C	2	yyyyyy	BCS2	BCS1	ETX

yyyyyy : 6 digits (ASCII decimal) of rated mV/V multiplied by 10000 for CORNER 2.
Poll the slave by using command '?'. Possible response messages: "ERR 91" or "CORN.3"

Master transmission:

STX	ADD	C	3	yyyyyy	BCS2	BCS1	ETX

yyyyyy : 6 digits (ASCII decimal) of rated mV/V multiplied by 10000 for CORNER 3.
Poll the slave by using command '?'. Possible response messages: "ERR 91" or "CORN.4"

Master transmission:

STX	ADD	C	4	yyyyyy	BCS2	BCS1	ETX

yyyyyy : 6 digits (ASCII decimal) of rated mV/V multiplied by 10000 for CORNER 4.
Poll the slave with command '?'.
Slave returns to normal Weight output after command is completed.

THE VALUES ARE NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

c. CALIBRATE CORNERS (WEIGHT)

It is used to compute correction factors for the corners by using weight equal to 10 - 30% of each load cell capacity. This command is in fact a procedure having a number of steps equal to the stated number of load cells. Empty the scale and send command:

Master transmission:

STX	ADD	C	0	BCS2	BCS1	ETX

Poll the slave by using command '?'.
Possible response messages: "WAIT.." or "ERR 91" or "CORN.1".
Place the test weight on scale CORNER 1, wait to stabilise and send command:

Master transmission:

STX	ADD	C	1	BCS2	BCS1	ETX

Poll the slave by using command '?'.
Possible response messages: "WAIT.." then "CORN.2" if corner 1 was ok,
or "CORN.1" if something is wrong. If the same corner is returned repeat the procedure.
Place the same test weight on scale CORNER 2, wait to stabilise and send command:

Master transmission:

STX	ADD	C	2	BCS2	BCS1	ETX

Poll the slave by using command '?'.
Possible response messages: "WAIT.." then "CORN.3" if corner 2 was ok,
or "CORN.2" if something is wrong. If the same corner is returned repeat the procedure.
Place the same test weight on scale CORNER 3, wait to stabilise and send command:

Master transmission:

STX	ADD	C	3	BCS2	BCS1	ETX

Poll the slave by using command '?'.
Possible response messages: "WAIT.." then "CORN.4" if corner 3 was ok,
or "CORN.3" if something is wrong. If the same corner is returned repeat the procedure.
Place the same test weight on scale CORNER 4, wait to stabilise and send command:

Master transmission:

STX	ADD	c	4	BCS2	BCS1	ETX

Poll the slave by using command '?'.
Possible response messages: 'WAIT..' then 'CORN.4' if something is wrong else the slave returns to normal weight output mode.
If the same corner is returned repeat the procedure.

THE VALUES ARE NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

d. UPLOAD CALIBRATION SECURITY PARAMETERS

The command is used by the master to upload the current status of the hardware CAL LOCK jumper, the software PIN LOCK state and the contents of the Audit Trail counter.

Master transmission:

STX	ADD	d	BCS2	BCS1	ETX

Slave response:

STX	ADD	d	x yyyyyy	BCS2	BCS1	ETX

Where x = 0 CALLOCK = Not inserted, PINLOCK = Not active
x = 1 CALLOCK = Inserted, PINLOCK = Not active
x = 2 CALLOCK = Not inserted, PINLOCK = Active
x = 3 CALLOCK = Inserted, PINLOCK = Active
yyyyyy = 6 digit Audit Trail Counter (MSD first).

f. UPLOAD CORNER FACTORS

It is used to upload corner factors.

Master transmission:

STX	ADD	f	x	BCS2	BCS1	ETX

Slave response:

STX	ADD	f	x	yyyyyy	BCS2	BCS1	ETX

x : One digit defining CORNER (1-4).
yyyyyy : 6 digits of the respective corner factor. (ASCII decimal)

G. GROSS

Clears any tare in use and returns slave to gross mode.

Master transmission:

STX	ADD	G	BCS2	BCS1	ETX

Slave response : NONE. The master may check execution of the command by examining the next status string.

J. LOCK / UNLOCK CALIBRATION (PINLOCK)

The command is used to activate or deactivate the software calibration lock.

UNLOCK: Deactivates the software lock and releases weight parameter and calibration changes.

Master transmission:

STX	ADD	J	0	xxxxxx	BCS2	BCS1	ETX

xxxxxx = 6 digit PIN

Slave response:

STX	ADD	J	0	xxxxxx	BCS2	BCS1	ETX

if the PIN was correct or NAK block followed by reset.

LOCK: Activates the software lock and disables further weight parameter and calibration attempts.

Master transmission:

STX	ADD	J	1	xxxxxx	BCS2	BCS1	ETX

xxxxxx = 6 digit PIN

Slave response:

STX	ADD	J	1	xxxxxx	BCS2	BCS1	ETX

NAK block if already locked.

THE VALUE IS NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

TO CHANGE PIN, FIRST UNLOCK WITH THE OLD PIN THEN LOCK WITH THE NEW PIN. BE CAREFUL WITH THE NEW PIN. IF IT IS LOST THE UNIT MUST BE RETURNED TO THE FACTORY TO RECLAIM IT.

i. UPLOAD INTERNAL RESOLUTION

Uploads internal resolution of slave VTDJB.

Master transmission:

STX	ADD	i	x	BCS2	BCS1	ETX

where x : One digit defining the corner number (0-4).
0 = Sum of the corners, 1= Corner 1, 2 = Corner 2, 3 = Corner 3, 4 = Corner 4.

Slave response:

STX	ADD	i	x	yyyyyy	BCS2	BCS1	ETX

where x : One digit defining the corner number (0-4).
0 = Sum of the corners, 1= Corner 1, 2 = Corner 2, 3 = Corner 3, 4 = Corner 4.
yyyyyy : 6 digits defining the data (ASCII decimal), of the respective corner.

P. DOWN LOAD PARAMETERS

Used to download scale parameters. The scale parameters are sent in three groups P1, P2, P3.

Master transmission: ***(PAR 1)***

STX	ADD	P	1	a	b	c	d	e	f	BCS2	BCS1	ETX

a : Conversion Rate: 1=8Hz/n , 2=20Hz/n , 3=40Hz/n , 4=80Hz/n where n=Nr of Load cells.
MAXIMUM Conversion Rate = 40Hz (i.e. 80Hz with one load cell is not acceptable).
b : Max Input Signal: 0 = 2 mV/V , 1 = 4 mV/V, for each input (Dead load + Span).
c : Number Of Loadcells: 1, 2, 3, 4
d : Weight units: 0 = kg
e : Digital Filter: 0, 1, 2 (0 = 1, 1 = 2, 2 = 4 samples)
f : No Motion Samples: 1, 2, 3, 4, 5, 6, 7 (consecutive conversions within 1e)

Slave response:

STX	ADD	ACK or NAK	BCS2	BCS1	ETX

A NAK block will be returned if any parameter is out of range.

Master transmission: ***(PAR 2)***

STX	ADD	P	2	aa	bb	cc	BCS2	BCS1	ETX

aa : Display Resolution: 01, 02, 05, 10, 20, 50
bb: Weighing Range: 01-99 (the first 2 digits of weighing range).
cc: Dual Interval Limit: 00-99 (the first 2 digits of the weighing range for which the lower weight resolution will be selected automatically).
00 = DUAL INTERVAL NOT ACTIVE.

Slave response:

STX	ADD	ACK or NAK	BCS2	BCS1	ETX

A NAK block will be returned if any parameter is out of range.

Master transmission: ***(PAR 3)***

STX	ADD	P	3	a	b	c	d	e	f	BCS2	BCS1	ETX

a : Number Of Decimals: 0, 1, 2, 3, 4
b : Auto Zero Tracking: 0 = NO 1 = YES
c : Auto Zero At Power Up: 0 = NO 1 = YES
d : Dual Digital Filter: 0 = NO 1 = YES (The filter doubles when not in motion)
e : Remove Leading Zero: 0 = NO 1 = YES
f : Reserved: always 0

Slave response:

STX	ADD	ACK or NAK	BCS2	BCS1	ETX

A NAK block will be returned if any parameter is out of range.

THE VALUES ARE NOT SAVED IN EEPROM UNTIL A STORE COMMAND IS ISSUED.

p. UPLOAD PARAMETERS

Used to upload weight parameters. The scale parameters are uploaded in three groups P1, P2, P3.

Master transmission: ***(PAR 1)***

STX	ADD	p	1	BCS2	BCS1	ETX

Slave response:

STX	ADD	p	1	a	b	c	d	e	f	BCS2	BCS1	ETX

a : Conversion Rate: 1=8Hz/n , 2=20Hz/n , 3=40Hz/n , 4=80Hz/n where n=Nr of Load cells.
b : Max Input Signal: 0 = 2 mV/V , 1 = 4 mV/V, for each input (Dead load + Span).
c : Number Of Loadcells: 1, 2, 3, 4
d : Weight units: 0 = kg
e : Digital Filter: 0, 1, 2 (0 = 1, 1 = 2, 2 = 4 samples)
f : No Motion Samples: 1, 2, 3, 4, 5, 6, 7 (consecutive conversions within 1e)

Master transmission: ***(PAR 2)***

STX	ADD	p	2	BCS2	BCS1	ETX

Slave response:

STX	ADD	p	2	aa	bb	cc	BCS2	BCS1	ETX

aa : Display Resolution: 01, 02, 05, 10, 20, 50
bb: Weighing Range: 01-99 (the first 2 digits of weighing range).
cc: Dual Interval Limit: 00-99 (the first 2 digits of the weighing range for which the lower weight resolution will be selected automatically).
00 = DUAL INTERVAL NOT ACTIVE.

Master transmission: ***(PAR 3)***

STX	ADD	p	3	BCS2	BCS1	ETX

Slave response:

STX	ADD	p	3	a	b	c	d	e	f	BCS2	BCS1	ETX

a : Number Of Decimals: 0, 1, 2, 3, 4
b : Auto Zero Tracking: 0 = NO 1 = YES
c : Auto Zero At Power Up: 0 = NO 1 = YES
d : Dual Digital Filter: 0 = NO 1 = YES (The filter doubles when not in motion)
e : Remove Leading Zero: 0 = NO 1 = YES
f : Reserved: always 0

Q : DOWNLOAD SETPOINT

Used to download the two digital setpoint values.

Master transmission:

STX	ADD	Q	x	yyyyy	BCS2	BCS1	ETX

x : One digit (1-2) defining setpoint number.
yyyyy : 5 digits defining setpoint value(ASCII decimal MSD). No decimal point.

Slave response:

STX	ADD	ACK or NAK	BCS2	BCS1	ETX

A NAK is returned if the values are not within Max.

q : UPLOAD SETPOINTS

Used to upload setpoint values from the DJB memory.

Master transmission:

STX	ADD	q	x	BCS2	BCS1	ETX

Slave response:

STX	ADD	q	x	yyyyy	BCS2	BCS1	ETX

x : One digit (1-2) defining setpoint number.
yyyyy : 5 digits defining setpoint value(ASCII decimal MSD).

R : RESET SLAVE

Resets the slave to its power on condition.

Master transmission:

STX	ADD	R	BCS2	BCS1	ETX

Slave response: NONE.

S: DOWN LOAD SETUP

Setup 1 is used to download the tilt switch interface parameters while setup 2 is used to download serial port 1 (RS485) interface parameters.

Master transmission: ***(SETUP 1)***

STX	ADD	S	1	X	Y	RRR	BCS2	BCS1	ETX

X : Tilt Switch Configuration: 0 = normally open contact (N.O), 1 = normally closed contact (N.C)
Y : Tilt Delay: 0 - 9 seconds (On/Off delay for contact debounce).
RRR= Reserved.
NOTE! If both X=0 and Y=0 the tilt function is disabled.

Slave response:

STX	ADD	ACK or NAK	BCS2	BCS1	ETX

A NAK is returned if the values are out of range.

Master transmission: ***(SETUP 2)***

STX	ADD	S	2	a	bb	cc	BCS2	BCS1	ETX

a : Slave Address: A - Z
bb : Baud Rate : 24 = 2400 baud 96 = 9600 baud 19 = 19200 baud
38 = 38400baud 57=57600baud 11=115200baud
cc : Data Bits/Parity : 17 = 7 data bits even parity 08 = 8 data bits, no parity.

Slave response:

STX	ADD	ACK or NAK	BCS2	BCS1	ETX

New settings of baud rate, data bits and parity are not in effect until a write command ‘W’ is issued.

s: UPLOAD SETUP1

Used to upload the tilt switch interface parameters.

Master transmission:

STX	ADD	s	1	BCS2	BCS1	ETX

Slave response:

STX	ADD	s	1	X	Y	RRR	BCS2	BCS1	ETX

X : Tilt Switch Configuration: 0 = normally open contact (N.O), 1 = normally closed contact (N.C)
Y : Tilt Delay: 0 - 9 seconds (On/Off delay for contact debounce).
RRR= Reserved.

T : TARE

Tares the weight on the scale and switches the VTDJB to net weight mode.

Master transmission:

STX	ADD	T	BCS2	BCS1	ETX

Slave response: NONE.

Execution of the command should be checked by examining the next status string.

W : WRITE TO EEPROM

Writes setup, parameters, setpoint values, and calibration data to EEPROM and resets slave.

Master transmission:

STX	ADD	W	BCS2	BCS1	ETX

Slave response: NONE.

WARNING : The max number of write cycles allowed is 100.000.

Z : ZERO SCALE

Sets the scale to zero if zero conditions are met (stable weight within 2% of scale capacity) .

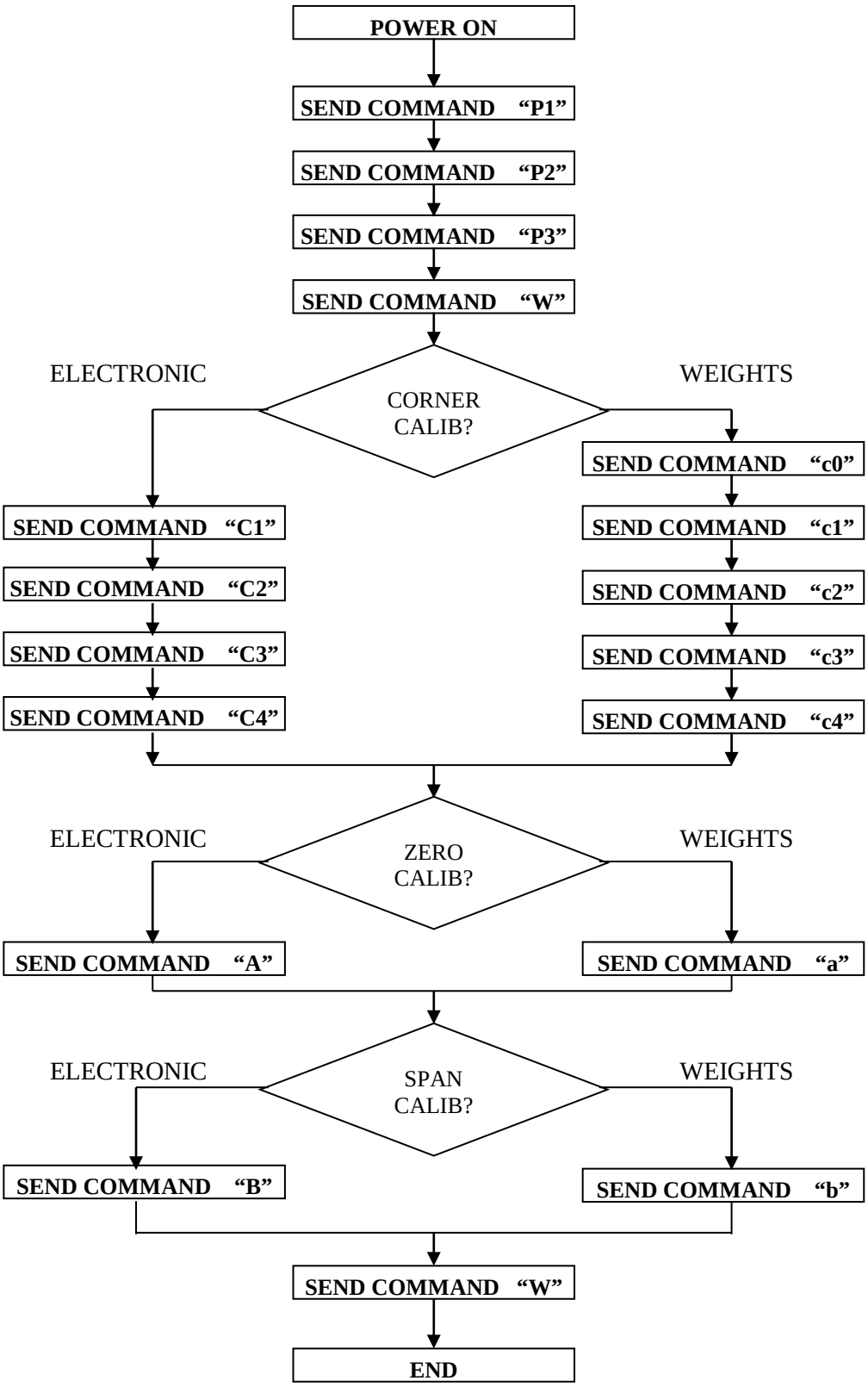
Master transmission:

STX	ADD	Z	BCS2	BCS1	ETX

Slave response: NONE.

Execution of the command should be checked by examining the next status string.

4 SETUP & CALIBRATION SEQUENCE



5 CALIBRATION EXAMPLES

5.1 STANDARD (WEIGHTS)

Assume a scale of 150kg / 50 g with dual interval at 60kg. The scale is constructed with 4 x 100kg load cells (2mV/V) at 5 conversion/sec with normal digital filter.

The calibration procedure should be as follows:
- Power on the VTDJB.
- Send scale parameters

STX	ADD	P	1	2	0	4	0	1	2	BCS2	BCS1	ETX

STX	ADD	P	2	05	15	06	BCS2	BCS1	ETX

STX	ADD	P	3	2	0	0	1	1	0	BCS2	BCS1	ETX

STX	ADD	W	BCS2	BCS1	ETX

Write to EEPROM

- Wait for VTDJB to power up.
- Empty scale and send command.

STX	ADD	c	0	BCS2	BCS1	ETX

- Place a test weight (20kg) on CORNER 1 and send command:

STX	ADD	c	1	BCS2	BCS1	ETX

- Place the same test weight on CORNER 2 and send command:

STX	ADD	c	2	BCS2	BCS1	ETX

- Place the same test weight on CORNER 3 and send command:

STX	ADD	c	3	BCS2	BCS1	ETX

- Place the same test weight on CORNER and send command:

STX	ADD	c	4	BCS2	BCS1	ETX

- Empty scale and send command:

STX	ADD	a	BCS2	BCS1	ETX

DEAD LOAD CALIBRATION

- Place a calibration weight (100kg) on the center of scale and send command:

STX	ADD	b	10000	BCS2	BCS1	ETX

- Save calibration in EEPROM

STX	ADD	W	BCS2	BCS1	ETX

- End.

5.2 ELECTRONIC (mV/V).

Assume a scale of Max= 30/60kg , e=0.010/0.020kg , with 4 load cells of rated capacity 50kg - 2mV/V each and the dead load is 1.940kg. Conversion rate is 5/sec , the digital filter is normal.
Load cell data:
L/C1: 1.9793 mV/V output at 50kg and zero balance: 0.0257 mV/V.
L/C2: 1.9392 mV/V output at 50kg and zero balance: 0.0276 mV/V.
L/C3: 1.9577 mV/V output at 50kg and zero balance: 0.0553 mV/V.
L/C4: 1.9640 mV/V output at 50kg and zero balance: -0.0022 mV/V.

SPAN average = (1.9793 + 1.9392 + 1.9577 +1.9640) / 4=1.9600 mV/V

L/C ZERO BALANCE average = (0.0257 + 0.0276 + 0.0553 + (-0.0022)) / 4 = 0.0266 mV/V

SCALE DEADLOAD: 1.9600 mV/V x (1.940 kg / (4x50kg)) = 0.0190 mV/V

OVERALL DEADLOAD = L/C ZERO BALANCE + SCALE DEADLOAD = 0.0456 mV/V

The calibration procedure should be as follows:
- Power on the VTDJB.

- Send CORNER DEFINITION commands:

STX	ADD	C	1	019793	BCS2	BCS1	ETX	CORNER 1

STX	ADD	C	2	019392	BCS2	BCS1	ETX	CORNER 2

STX	ADD	C	3	019577	BCS2	BCS1	ETX	CORNER 3

STX	ADD	C	4	019640	BCS2	BCS1	ETX	CORNER 4

- Send DEAD LOAD calibration command:

STX	ADD	A	000456	BCS2	BCS1	ETX

- Send SPAN calibration command:

STX	ADD	B	50000	BCS2	BCS1	ETX

RATED CAPACITY OF EACH LOAD CELL

- Send STORE command to save in EEPROM

STX	ADD	W	BCS2	BCS1	ETX

- End.

6 PARAMETER DESCRIPTION

Weighing Range: (PAR 2)	The first two digits of weighing range. Add three zeroes to get the weighing range (xx000). Range 01-99.
Display resolution: (PAR 2)	Defines the resolution of the weight value. Resolution is understood to mean the smallest weight changed presented. Possible values: 01, 02, 05, 10, 20 or 50.
Number Of Decimals: (PAR 3)	Number of decimals in the weight value. Possible values: 0 – 4.
Dual Interval Limit: (PAR 2)	The first two digits of dual interval limit. Add three zeroes to get the dual interval limit (xx000). This is the limit where the weight resolution shall change, providing that the "Display Resolution" is set to a value higher than 1. The set "Display Resolution" (e.g. 05) will be used if the weight is above the "Dual Interval Limit" and the next higher (finer) resolution (e.g. 02 in this case) will be used if the weight is below this limit. To turn off this function set "Dual Interval Limit" = 0. Range 00 – 99. NOTE: Must be less than "Weighing Range".
Digital Filter: (PAR 1)	Defines how many weight samples that are used in the digital filter. Possible values: 0 = 1, 1 = 2 or 2 = 4 samples.
Dual Digital Filter: (PAR 3)	Defines if the digital filter length shall be doubled when the weight is stable (not in motion). Possible values: 0 = No or 1 = Yes.
No Motion Samples: (PAR 1)	Number of weight samples within 1e until the weight is regarded as stable (No Motion bit in status byte = 1). Possible values: 1 - 7 samples.
Conversion Rate: (PAR 1)	Weight conversion rate. Possible values: 1 = 8Hz/n, 2 = 20Hz/n, 3 = 40Hz/n or 4 = 80Hz/n where n = Number of load cells. NOTE! Maximum conversion rate is 40 Hz, this means that "4" (80 Hz) with one load cell is not acceptable.
Number Of Loadcells: (PAR 1)	Number of connected load cells. Possible values: 1-4.
Max Input Signal: (PAR 1)	Maximum allowed signal on one load cell input. Possible values: 0 = 2.0 mV/V or 1 = 4.0 mV/V.
Auto Zero Tracking: (PAR 3)	If this parameter is set to "1" (Yes), then the scale is zeroed continuously if the input drifts slowly as long as the total zeroing is within allowed range (± 2 % of Weighing Range) Possible values: 0 = No or 1 = Yes.

Auto Zero At Power Up: (PAR 3)	If this parameter is set to "1" (Yes), then the scale is set to zero at power on if the gross weight is stable and within allowed range (± 2 % of Weighing Range). If it is not possible to perform the zero setting then the scale will enter an error condition (error 15) that must be acknowledged by sending a ACK block. Possible values: 0 = No or 1 = Yes.
Remove Leading Zero: (PAR 3)	Defines if leading zeroes in the weight value shall be removed (substituted by spaces). Possible values: 0 = No or 1 = Yes.
Tilt Switch Configuration: (SETUP 1)	The "Tilt Switch" inputs can be used to generate an alarm, e.g. if the scale is tilted too much. The Tilt Switch inputs shall normally be open or closed (configurable) and shall change state in case of an error. Possible values: 0 = Input normally open (N.O.) or 1 = Input normally closed (N.C.). NOTE! To turn off the tilt alarm function, set the "Tilt Switch Configuration" parameter to "0" (N.O.) and the "Tilt Delay" time to zero (0).
Tilt Delay: (SETUP 1)	A delay time used to debounce tilt switch input. Possible values: 0 – 9 (seconds).
Scale Address: (SETUP 2)	Scale address used for serial communication. Possible values: A – Z
Baud Rate: (SETUP 2)	Serial communication baud rate. Possible values: 24 = 2400, 96 = 9600, 19 = 19200, 38 = 38400, 57 = 57600 or 11 = 115200.
Data Bits/Parity: (SETUP 2)	Serial communication data bit configuration. Possible values: 08 = 8 data bits and no parity, 17 = 7 data bits and even parity.

7 OPERATION

All data from the VTDJB is available through the serial interface.

When the unit is powered up or when the RESET command is received, the unit goes through an initialization procedure during which the CPU, memory and peripherals are checked.
The POST period is approximately 15 seconds (depends on the conversion rate).

Then the unit is ready for operation. Immediately after the POST the unit will auto-zero (if auto zero on Power-up is enabled).

To get the weight scan with file type "?".

To set the scale to zero send file type "Z" . It will be executed only if the zero conditions are met (no motion and weight within ± 2% of Weighing Range).

To Tare the scale send file type "T". It will be executed only if Tare conditions are satisfied (no motion and weight within Weighing Range).

To clear the tare and return to Gross send file type "G".

To down load the setpoints :
a. Send command "Q1" for the first setpoint.
b. Send command "Q2" for the second setpoint.
The setpoint values must be within Weighing Range to be accepted.
The set point values downloaded will be lost in power down.
To save them permanently in EEPROM send "W" file type.
To upload the setpoints use the "q" file type.

During the POST period instead of weight the unit will return the following messages in response to "?" command.

"VTDJB" The software code.
"V2.0" The version number.

If a Tilt switch is connected the weight output will be inhibited and E tilt will be transmitted when the scale is tilted. Refer to command S, the Parameter Description and Annex A for software and hardware details of the tilt switch.

An indicator LED on PCB 703.2 signals the operational status of the DJB by flashing at intervals of 2sec.
One flash signals ok. Two flashes signal error.

8 ERRORS

This chapter provides information on error messages and troubleshooting instructions.
Errors may be hardware or software related. They are output in the form ERR xx, where xx is the error code. The Master computer must send ACK block to acknowledge the error.
Following is a list of errors with indication of possible causes and probable remedy.

ERROR	POSSIBLE CAUSE	ACTION TO BE TAKEN
ERR 01	System ROM. Faulty IC 2	Check solder connections or contact manufacturer
ERR 02	System RAM. Faulty IC 2	Check solder connections or contact manufacturer
ERR 04	Calibration loss or faulty EEPROM IC 1	Recalibrate or contact manufacturer
ERR 05	Mechanical failure or load cell or A/D converter IC 13	Check scale, load cell cables, reset DJB, power off-wait 5sec-power on, contact manufacturer.
ERR 15	System has been initialised due to power failure or soft reset	Empty scale and set to Zero .
ERR 90	Not enough weight for span calibration	Recalibrate.
ERR 91	Calibration lock jumper is inserted, or software lock is activated.	Remove calibration lock jumper, or unlock calibration.

TROUBLESHOOTING

SYMPTOMS	ACTION TO BE TAKEN
Led D10 does not light.	Check the ac/dc supply. If the power is present but there are no 5Vdc check fuse F13. Replace if necessary with same type fuse only.
VTDJB does not communicate with HOST.	Check communication setup (baud rate, data bits, parity, VTDJB address). Check communication cable. Check polarity of RS485 (Refer to appendix A paragraph 11.2 PCB 703.2).
Weight output from VTDJB is too slow.	Decrease number of VTDJB (s) to be scanned at HOST. Increase Baud Rate. Increase number of conversions per second.
Corner calibration does not proceed.	Check number of load cells connected and setup parameters of VTDJB (e.g for a weigh system with 2 load cells, set number of load cells=2). Place a test weight on each corner in turn and verify (using internal resolution corner reading) that there is a positive change in resolution. Use calibration weight equal to 10-30% of each load cell capacity. Check load cells and connector screw terminals (if not tight push with a tool from the opposite side of the screw).
Weight output from VTDJB is not stable.	Check calibration data. Reduce external divisions or lower conversion rate or increase digital filter, check number of load cells. Check power supply. Check load cell connection(s) and cable(s). Check input and output resistance and resistance between any terminal and shield.
Weight Output is not the same on each corner.	Check that the scale is mechanically OK and it is free on all sides. Check load cell connection(s) and cable(s). Check input and output resistance and resistance between any terminal and shield. Check calibration data. Recalibrate corners with sufficient stabilization time.

9 SPECIFICATIONS - MAINTENANCE

9.1 TECHNICAL SPECIFICATIONS

ACCURACY CLASS	III
RESOLUTION	Selectable up to 99.000 dd (in accordance with regulations).
MAX TARE EFFECT	- Max
AUTO ZERO TRACK	Off or 0.5 dd setup selectable.
WEIGHT DIGITS	5
WEIGHT STEPS	1, 2, 5, 10, 20, 50
DIGITAL FILTER	Rolling average (1, 2, 4 samples).
DIGITAL CALIBRATION	Digital corner calibration, Dead load, Span and scale. Parameters via serial commands. Calibration may be performed by application of weights or by the mV/V values of each load cell. No interaction between dead load and span.
LOAD CELL EXCITATION	+ 5 VDC
NUMBER OF LOAD CELLS	1 to 4 selectable.
LOAD CELL CONNECTION	4 wire technique. Max 4 load cells 350 Ohm each.
ANALOG INPUT RANGE	-0.25 to 4 mV/V for each load cell. (- 1.25mV to 20 mV).
MIN INPUT PER VSI	0.4 µV / increment.
INPUT AMPLIFIER	Input noise 0.3µVp-p. Analogue filter passive 2pole 10Hz.
A/D CONVERTER	Sigma delta 550 000 internal counts max. Conversion speed 8, 20, 40, 80 conversions/sec (selectable) divided by the number of load cells used (Max 40).
LINEARITY	Within 0,002% of full scale.
SPAN TEMP - COEFF	< 2 ppm / ^{o}C
ZERO TEMP - COEFF	< 2 ppm / ^{o}C
LONG TERM STABILITY	0.005 % of full scale per year.
DIGITAL PART	CPU 89C55 with reset and watchdog, EEPROM calibration memory. TTL serial port for either Display and Keyboard or analogue interface. Digital tilt interface.
COMMUNICATIONS	RS485A serial port half duplex. (Default 9600, E, 7, 1) Baud rate 2400 to 115000 baud set up selectable. 1 start bit, 7 or 8 data bits, even or no parity, 1 stop bit.
POWER SUPPLY	7-10 VAC or 7.5 - 12VDC external / 150mA.
POWER CONSUMPTION	1.8W max with 4 x 350 Ohm load cells.
DIGITAL INPUT (x1)	24VDC ±20% negative common. Input impedance 3.3 KΩ. On/Off delay 2ms. Optoisolated to 2.5KV.
DIGITAL OUTPUT (x2)	24VDC ±10% transistor (sink) negative common. Max Current 10mA. Max off state voltage 30VDC. Leakage current 50µA. On/off delay 2ms. Optoisolated to 2.5KV.
ANALOG OUTPUT	Optoisolated, current. Hardware selectable 0-20mA or 4-20mA.
POWER SUPPLY	External 15-24VDC/35mA max.
RESOLUTION	16 bit (1/65535) Full scale.
RELATIVE ACCURACY	+ 0.012% MAX.
OFFSET AT 25^{o}C	+ 0.05% MAX.
OFFSET DRIFT	50ppm/ ^{o}C.
TOTAL OUTPUT ERROR	±0.15% (20mA) at 25^{o}C.
TOTAL OUTPUT DRIFT	50ppm/ ^{o}C MAX.
EMC COMPATIBILITY	Compliant with EN 45501 standards.

9.2 ENVIRONMENTAL CONSIDERATIONS

AMBIENT TEMPERATURE	Storage -10 to +70 ^{0}C. Operating -10 to +40 ^{0}C.
HUMIDITY	40 to 90% RH (non condensing)
VIBRATION	Severe vibration can affect the accuracy of weighing and damage Electric/electronic components.
AIR	The surrounding air should be dust free and not contain any corrosive gasses or materials which could adversely affect the equipment.
PROTECTION	IP65.
INCOMING AND OUTGOING SIGNALS	Relays and contactors connected to the equipment must have reliable and effective interference suppression. This also applies to other equipment located within a distance of 3 m from out equipment. Cabling must be performed according to normal practice.
NOTES	- WELDING on or in the vicinity of the equipment is strictly prohibited. - STATIC loads, caused by thunderstorms, have to be prevented from developing by use of reliable lightning conductors. - ENSURE that the cooling of the equipment is not obstructed.

9.3 MAINTENANCE

The unit does not require any routine maintenance. It may be necessary to perform periodic check of the calibration of the scale due to mechanical reasons. The frequency of the calibration checks depends on the application condition and on the required measuring accuracy.
It may happen that, in exceptional conditions, the unit locks on a wrong memory location and it is not possible to restart because the keyboard is not operative.
To restart it is necessary to switch the power OFF the ON again.

9.4 SERVICE

- There are no serviceable parts. The unit may be repaired by trained personal only. The user may check load cell connection and power supply.
- LOAD CELLS
  Load cells are reliable and very rarely present errors. Check input and output resistance, and resistance between any terminal and shield. Check load cell connection and cable.
- POWER SUPPLY
  Check the ac/dc supply. If the power is present but there are no 5VDC on the board check the 200mA auto-reset fuse. Replace if necessary with same type fuse only.

10 DJBExplorer

The DJBExplorer is a setup and utility PC program for the Digital Junction Box, VTDJB. The program is primarily intended for setup and calibration but it is also possible to see the weight and to perform the basic scale operations.

10.1 System Requirements

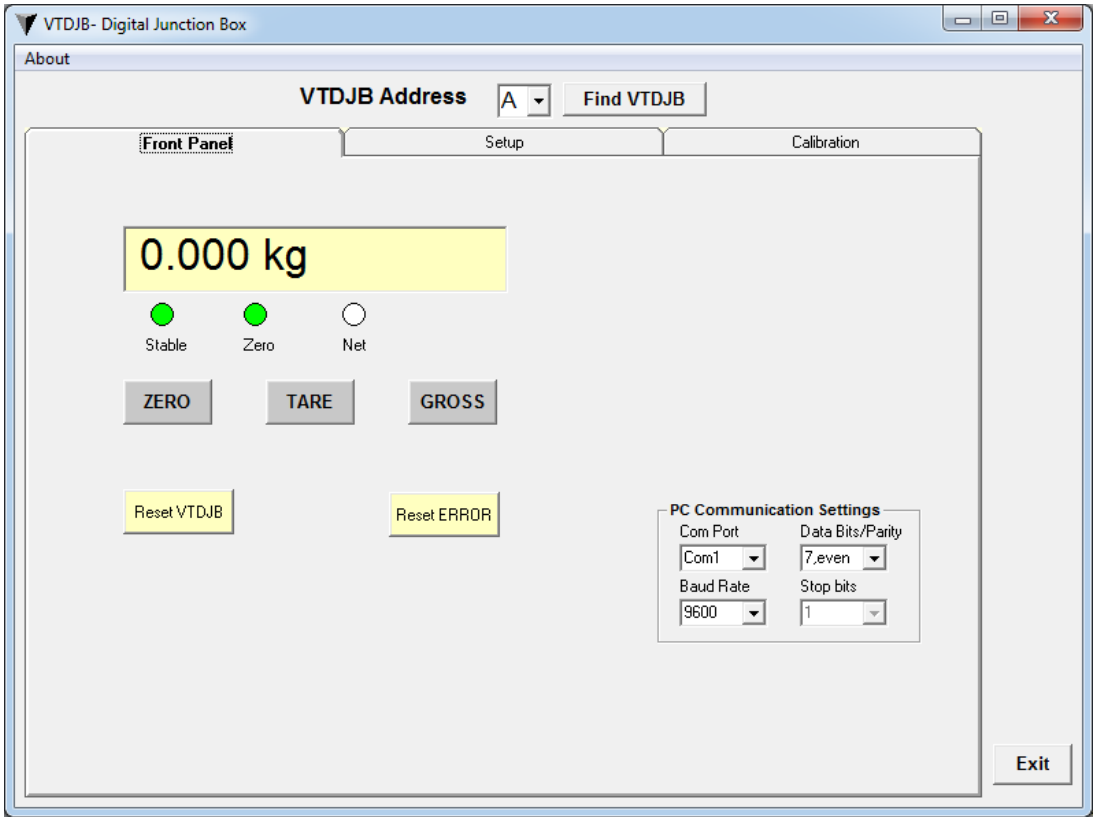
DJBExplorer installs on any PC with Windows XP or Windows 7 operating system. The PC must support serial communication using RS485 (built in, external RS232 to RS485 converter or USB to RS485 converter). Recommended PC display resolution is 800 x 600 or better.

10.2 Getting Started

DJBExplorer is designed for the European version of the Digital Junction Box, VTDJB (V2.5). After installing the DJBExplorer connect the device to the PC through a RS485 serial port.
On the first program start the communication protocol default values are COM1, 9600, e, 7, 1 and the address is set to A.

10.3 VTDJB Address

The address of the connected VTDJB is displayed. To switch to another VTDJB, select another VTDJB's address. You must not connect two or more VTDJBs with the same address to the DJBExplorer (each VTDJB must have its own address).



10.4 Front Panel

Contains the VTDJB keyboard, annunciators and PC communication settings.

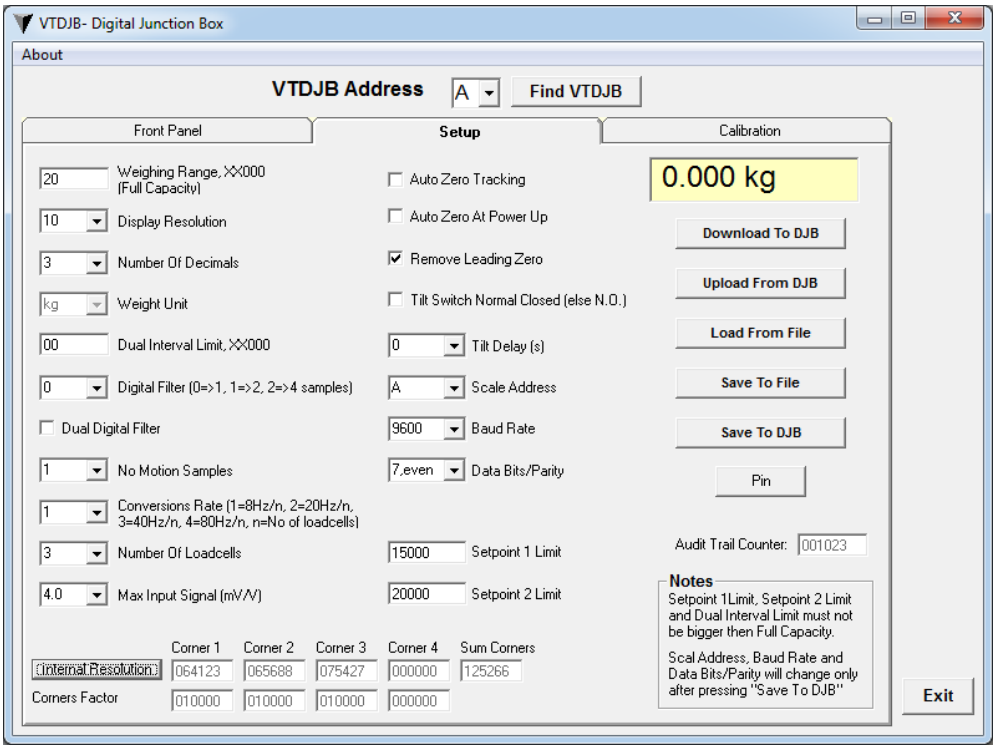
PC Communication settings
Set the PC communication settings identically to those in the VTDJB, if one parameter or more is not identical, a message "No Reply" will be displayed. In case of changing the VTDJB communication settings, it's recommended to register it somewhere you can find if necessary.

10.5 Setup Screen

The Setup screen enables viewing and modifying the VTJDB setup, saving current setup configuration to a file or to the VTJDB, and loading setup configuration from a file or from the VTJDB.

For Information about the parameters, their values and their functionality, see section 6, Parameter Description.

Important Note - If protection jumper JP1 is inserted in the device or password is set, saving to the VTDJB is not possible.



Internal Resolution and **Corners Factor** are read only, the values are determined during calibration.

Download To VTDJB
Downloading the displayed parameters values to a temporary memory in the VTDJB, until powering off the device.

Upload From VTDJB
Uploading the parameters values from the VTDJB and display them on the screen.

Load From File
Loading the parameters values from a file and display them on the screen.

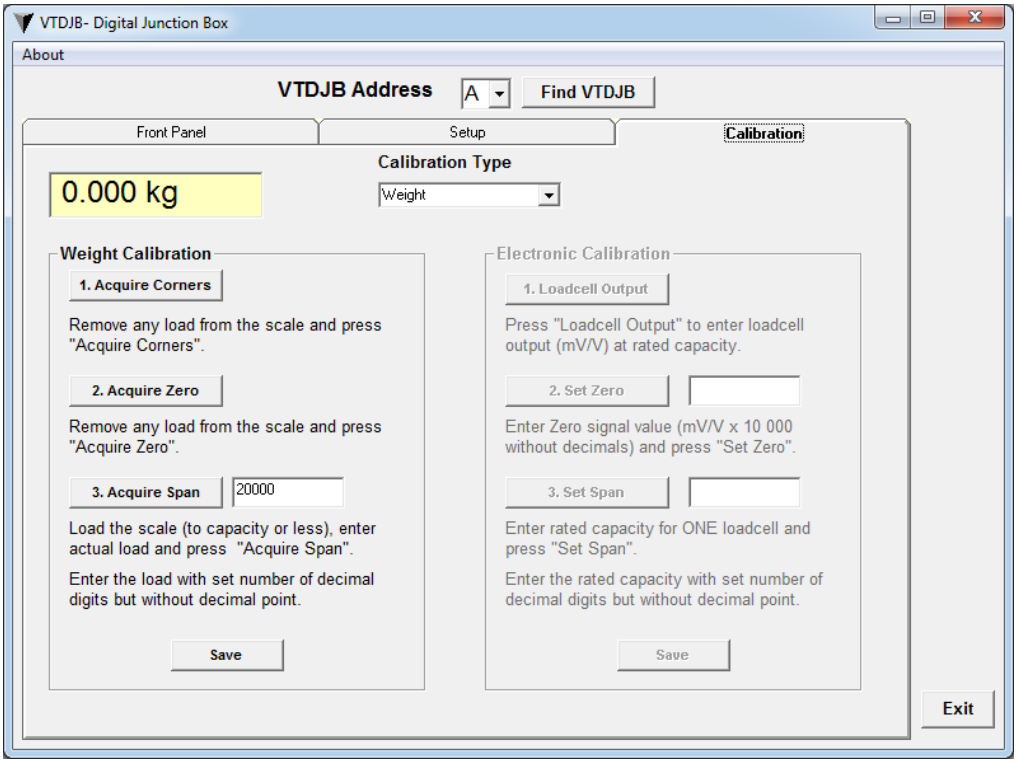
Save To File
Saving the displayed parameters values to a text file.

Save To VTDJB
Saving the displayed parameters values to a permanent memory in the VTDJB.

Pin
Used to set/reset the VTDJB password (Pin code).

10.6 VTDJB Calibration

Important Note - If protection jumper JP1 is inserted in the device or password is set, calibration is not possible.



Calibration Type

Two ways of calibration are offered.

- Weight: This is a regular calibration using known load.
- Electronic: This requires the mV/V values for the load cells. This type of calibration is not very accurate.

Weight calibration procedure (see also section 4 and 5)

- Select Calibration Type “Weight”.
- Be sure that the scale is empty (except for permanent mounted equipment).
- Press “Acquire Corners” to start the corner calibration. Follow the instructions and load each loadcell (scale corner) with a known weight of 10-30 % of the loadcell capacity.
- Be sure that the scale is empty.
- Press “Acquire Zero” to set the zero point.
- Load the scale with known weights on the middle of the scale. The load shall be as high as possible but less than the set “Weighing Range”.
- Enter the known load (with set number of decimals but without the decimal point) in the box to the right of the “Acquire Span” button.
- Press the “Acquire Span” button to perform the span calibration.
- If you are satisfied, press “Save” to save the calibration permanently in the VTDJB.

Electronic calibration procedure (see also section 4 and 5)

- Select Calibration Type “Electronic”.
- Press “Loadcell Output” to enter the rated output (mV/V) for each loadcell in use. The rated output to enter shall be multiplied by 10 000 and possible decimals shall be ignored.
- Calculate a mV/V value that corresponds to the load on the loadcells when the scale are empty and enter that value in the box to the right of the “Set Zero” button (in order to achieve a displayed value of zero (0) for an empty scale).
  It is also possible to enter zero (0) here and change to “Weight” calibration and press “Acquire Zero” with an empty scale later on when the when this procedure are ready.
- Press “Set Zero” to store the zero value in the VTDJB.
- Enter the rated capacity for ONE loadcell in the box to the right of the “Set Span” button. Enter the capacity with set number of decimals but without the decimal point.
- Press “Set Span” to store the span value in the VTDJB.
- If you are satisfied, press “Save” to save the calibration permanently in the VTDJB.

Zero setting procedure

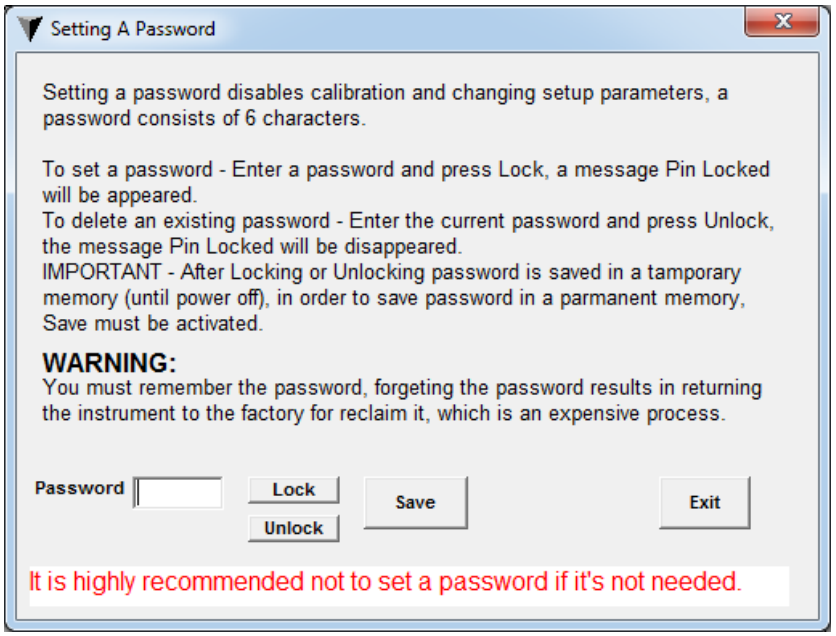
If some conditions have changed, e.g. the construction on the scale has been rebuild so the weight has changed significantly or the scale shows “Overload” during configuration, it might be necessary to make a new zero setting.

- Select Calibration Type “Weight”.
- Be sure that the scale is empty (except for permanent mounted equipment).
- Press “Acquire Zero” to set the zero point.
- If you are satisfied, press “Save” to save the calibration permanently in the VTDJB.

10.7 Setting a Password

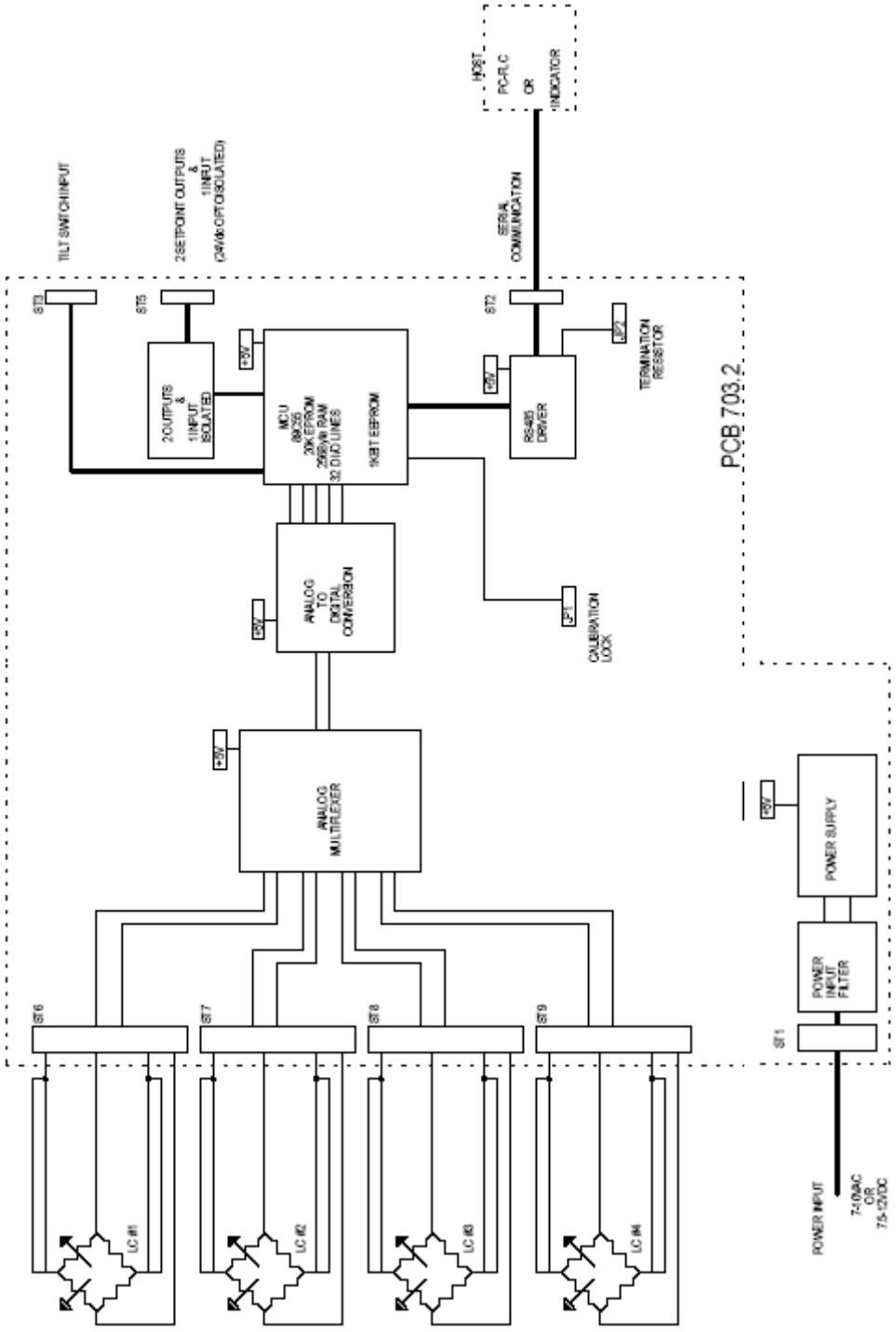
By pressing the Pin button in the “Setup” tab, the below window will be displayed with the relevant instructions, in which you can set a password or cancel an existing password.

Very Important – It’s highly recommended not to set a password if it’s not needed. In case of setting a password and forgetting it, the unit must be returned to the factory for replacing the CPU, which is a process that the customer will be charged for.

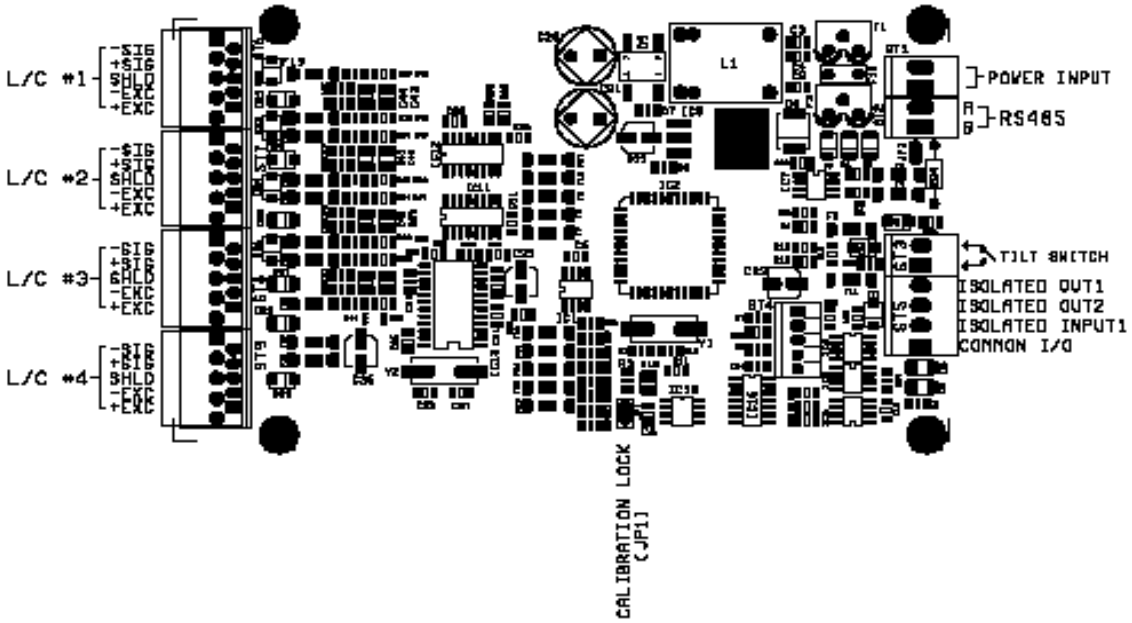


11 APPENDIX A

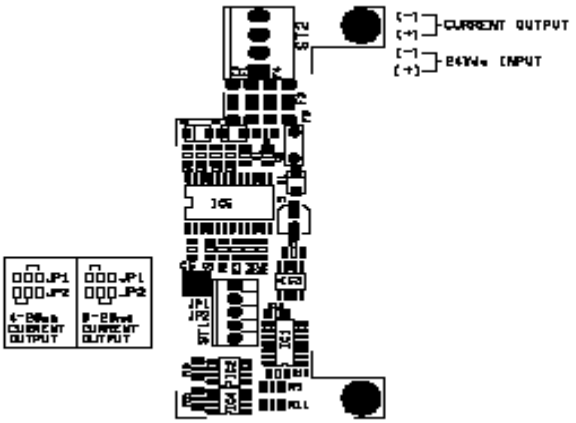
11.1 SYSTEM BLOCK BIAGRAM



11.2 COMPONENT LAYOUT AND CONNECTIONS

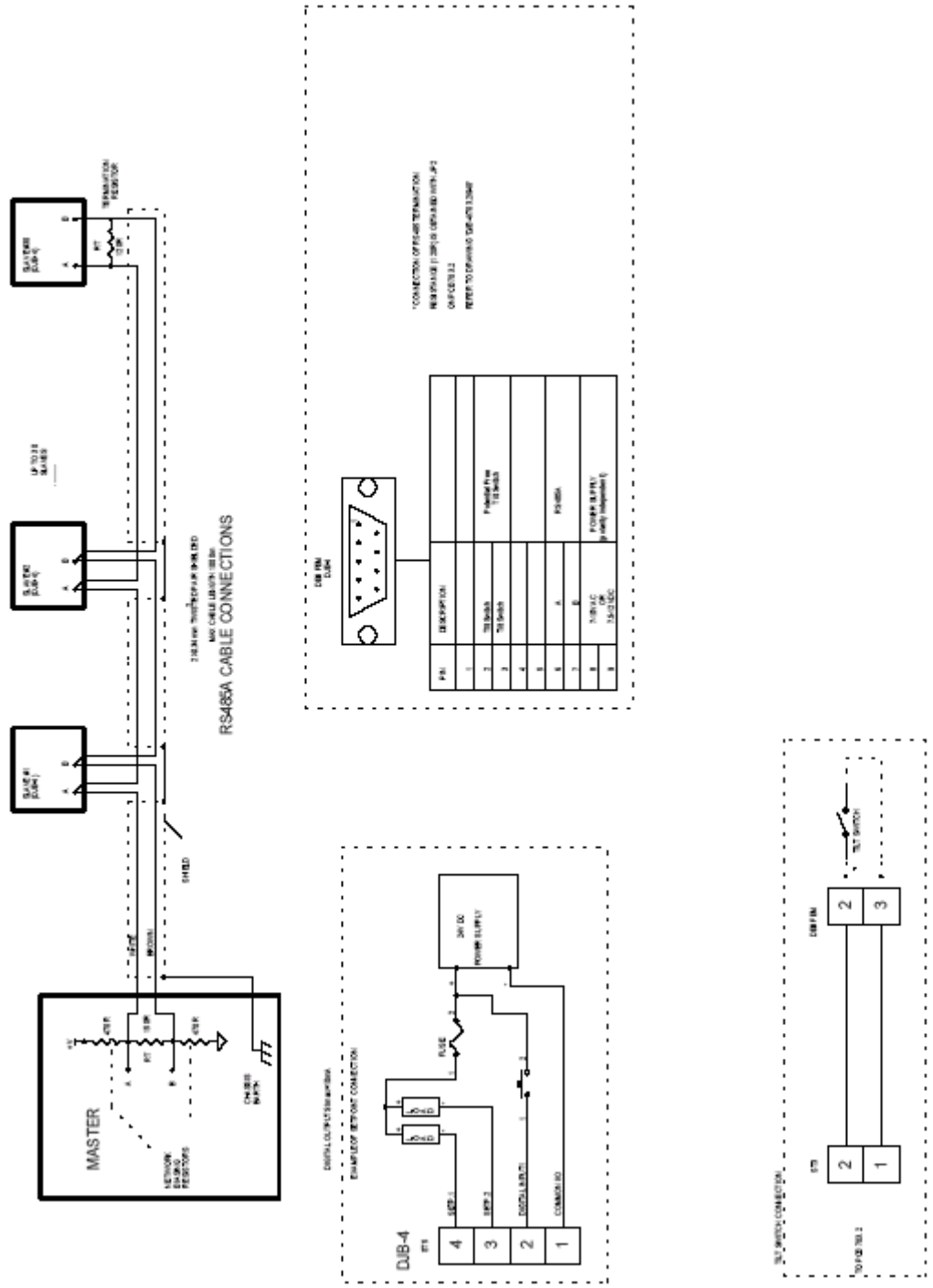


PCB 703.2



PCB 760 Analogue output

11.3 CABLING DIAGRAM



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