ST40 Instrument Systems Service Manual

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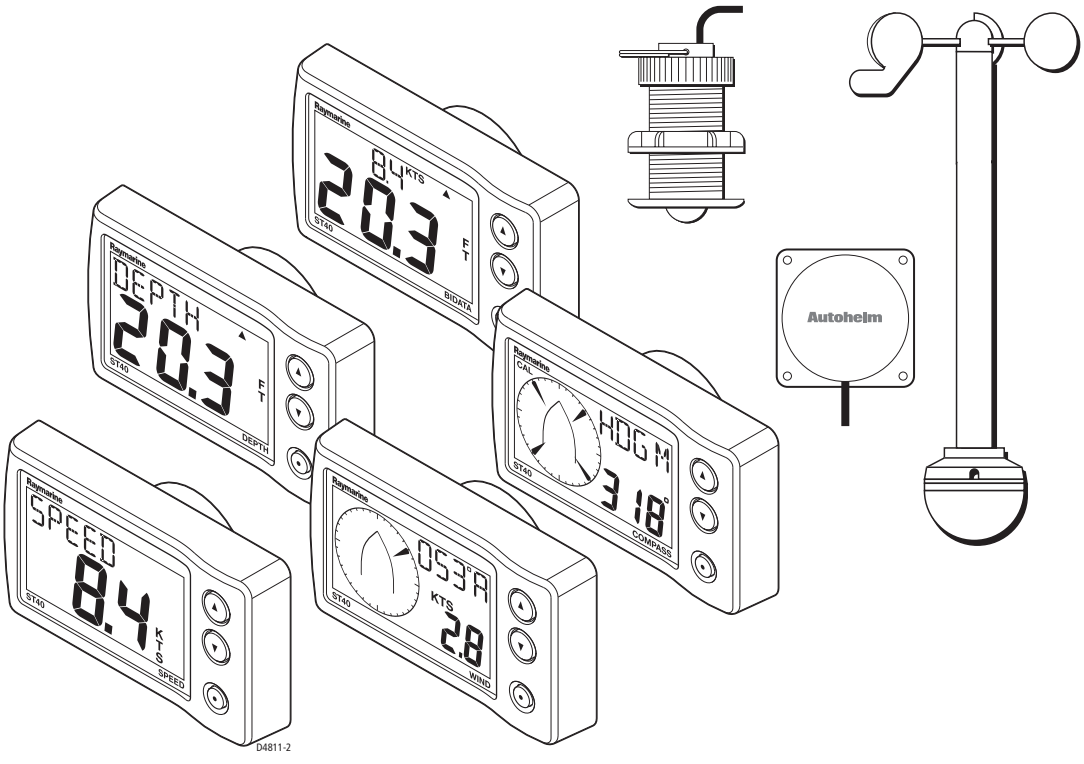
1st February 2004

Instruments

Speed
Depth
Bidata
Wind
Compass

Transducers

Speed
Rotavecta
Fluxgate Compass



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ST40 Instrument Systems Service Manual

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Part 2 Instrument Servicing

Part 3 Transducer Servicing

Warning

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Part 1 Instrument Disassembly & Reassembly

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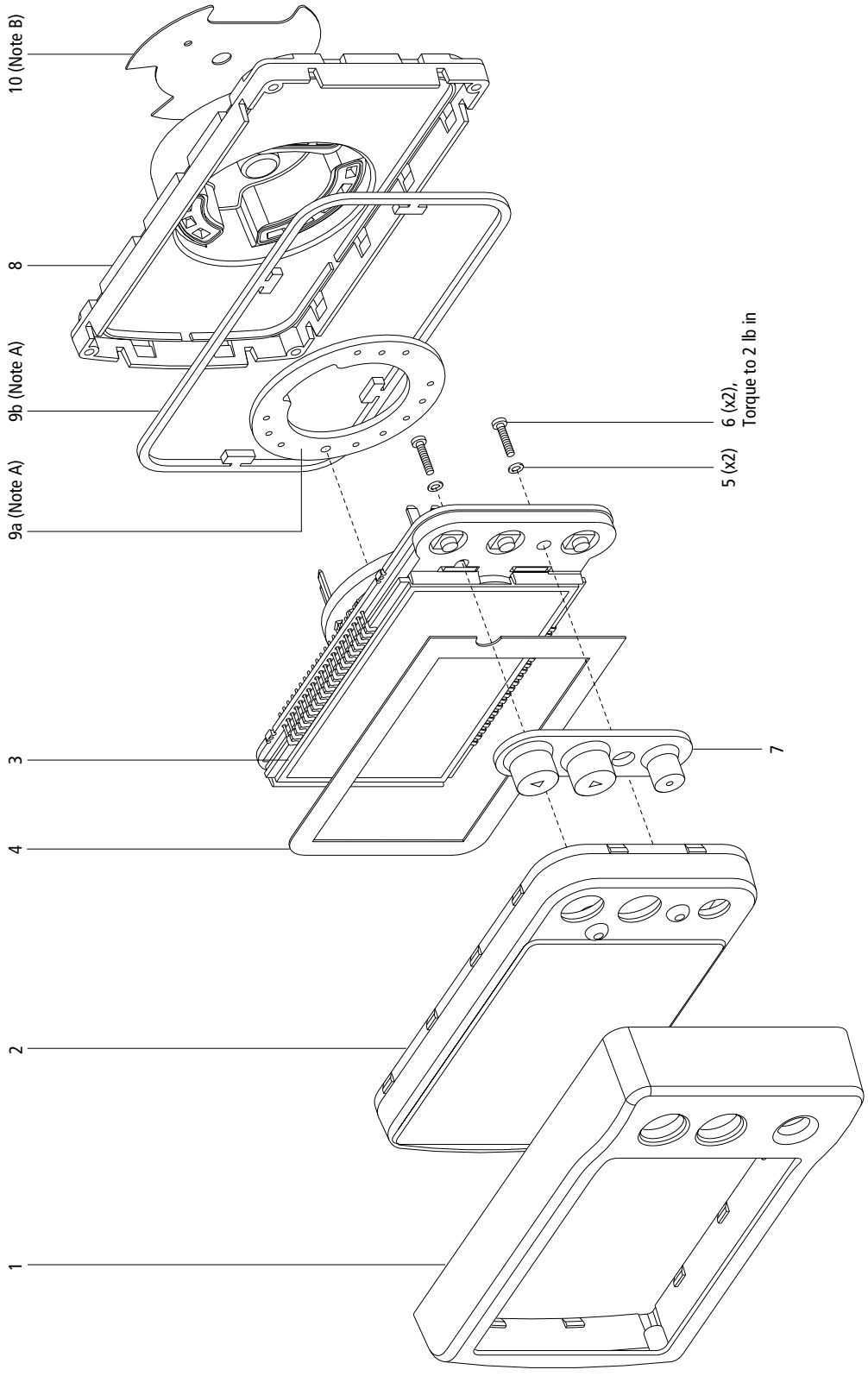
ST40 Instrument exploded view



ST40 instrument spare parts list

The item numbers are shown in the *ST40 instrument construction* illustration.

Item	Description	Part No.	Comments
1	Bezel		
	Grey	E25020	Standard
	Silver	E25021	Optional
	Carbon	E25022	Optional
	Flip-flop	E25023	Optional
2	Front fascia	A28072	
3	PCB/LCD/Spade assembly		
	Speed	A28074	
	Depth	A28075	
	Bidata	A28077	
	Wind	A28076	
	Compass	A28078	
Each PCB/LCD/Spade assembly includes			
4	Display label (appropriate to PCB/LCD/Spade Assembly type)		
5	Washer (x2)		
6	Screw (x2)		
7	Keypad mat	A28079	
8	Back case	A28073	
Includes			
9a	Case seal, inner		
9b	Case seal, outer		
10	Rear labels (x5, one for each instrument type)		
–	Suncover	E25027	Not illustrated

Disassembly

In order to completely disassemble an ST40 instrument, ensure you have a Back Case Removal Tool, Part No. E25031, available from Raymarine.

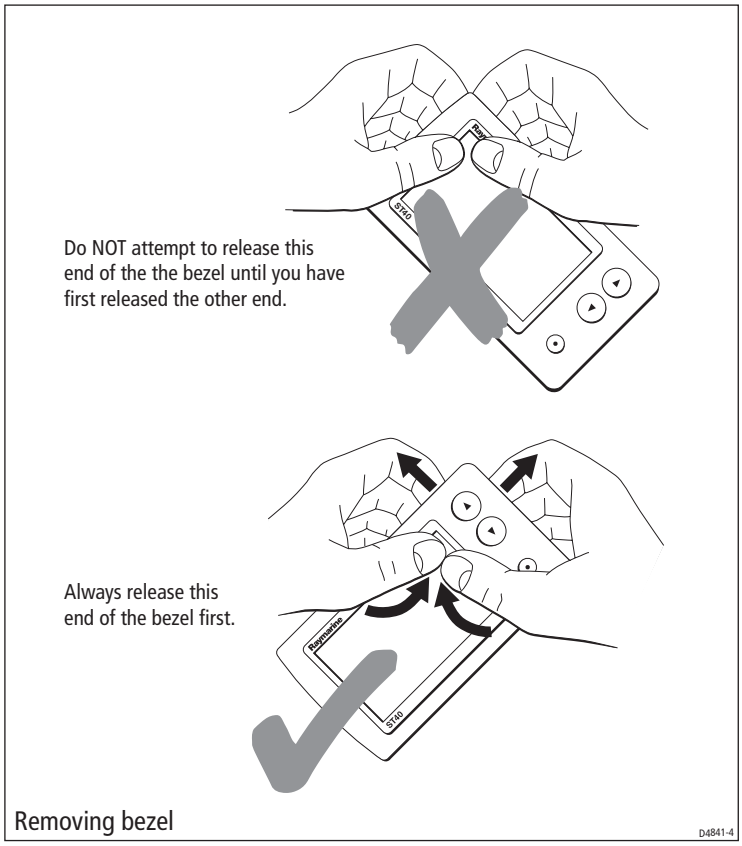
As it is recommended that new inner and outer seals (9a) and (9b) are fitted each time an ST40 instrument is reassembled, ensure that new seals are available, before commencing disassembly.

To disassemble an ST40 instrument:

1. Referring to the *Removing bezel* illustration (overleaf), unclip the bezel (1) from the front fascia (2) as follows:

   (a) Hold the instrument in both hands with the display towards you.

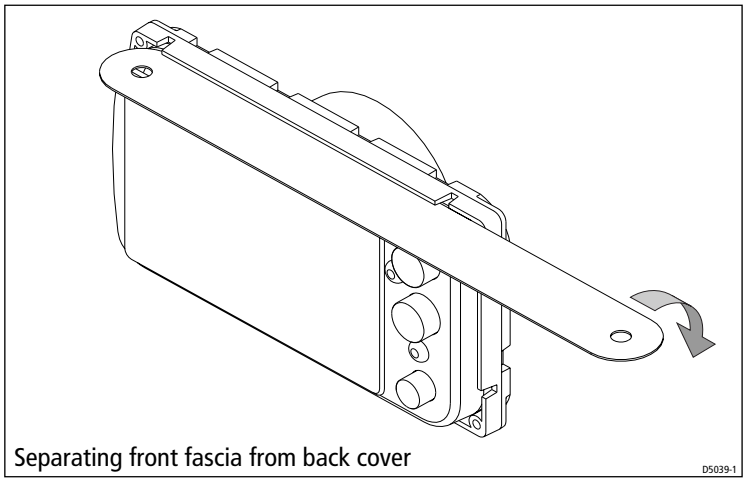
(b) At the control-key end of the instrument, gently press one corner of the screen, at the same time easing-out the edges of the bezel with your fingers, then repeat the procedure at the adjacent corner, to release that end of the instrument from the bezel.



Removing bezel

(c) At the other end of the instrument, ease the top and bottom bezel edges outwards to unclip them, then withdraw the instrument, from the bezel.

2. Insert the back case removal tool between the front fascia (2) and the back case (8) as shown, then gently twist the tool to prise the front fascia from the back cover.



Separating front fascia from back cover

3. Repeat this procedure for each edge of the instrument, until the front fascia and the back case are completely separated.

4. Remove and retain the two screws and washers (6) and (5) which secure the PCB/LCD spade assembly (3) and the front fascia (2) together.
5. Separate the PCB/LCD spade assembly (3), front fascia (2), keypad mat (7) and display label (4).
6. Note how the inner and outer case seals (9a) and (9b) are fitted, then remove and discard both seals.

Disassembly is now complete.

Reassembly

If you are fitting a new back case (8), carry out the following procedure, before reassembling the instrument:

1. Keep a record of the serial number of the instrument (this is shown on the label on the rear of the original back case).
2. Select the appropriate instrument label (10) from the five provided, peel off the protective sheet and ensuring correct orientation, stick the label to the rear of the replacement back case.

To reassemble an ST40 instrument:

1. Insert the keypad mat (7) in its correct position in the front fascia assembly (2).
2. Place the display label (4) in position in the front fascia assembly.

CAUTION:

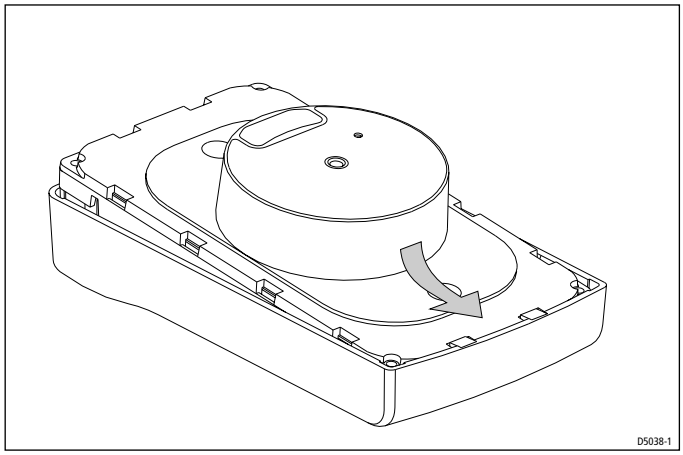
Damage to the ST40 instrument can occur if screws are overtightened. Always use the recommended torque values.

3. Fit the PCB/LCD/spade assembly (3) to the front fascia (2) and secure these items together with the two screws and washers (6) and (5). Tighten to a torque of 22 Nm (2 lb inches).

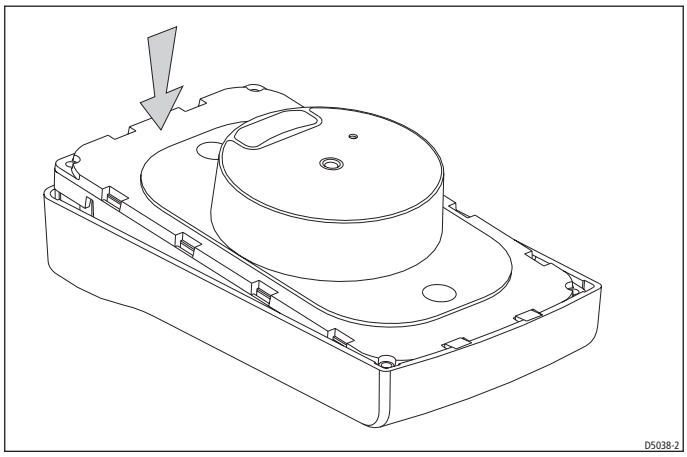
4 Fit a new inner seal (9a) to the rear of the PCB/LCD/spade assembly (3), ensuring that it is correctly orientated and that it lies flat on the carrier.

5 Fit a new outer seal (9b) inside the back case, ensuring that the positioning lugs are correctly located.

6. Clip the front fascia (2) and the remaining components (3) to (10) together. Press along each edge to ensure that all clips are fully made.
7. Fit the instrument into the bezel, so the curved end of the instrument slides under the lugs on the bezel, as shown in the following illustration.



8 Gently but firmly press the bezel onto the instrument until it clicks into place.



Reassembly is now complete.

Part 2 Instrument Servicing

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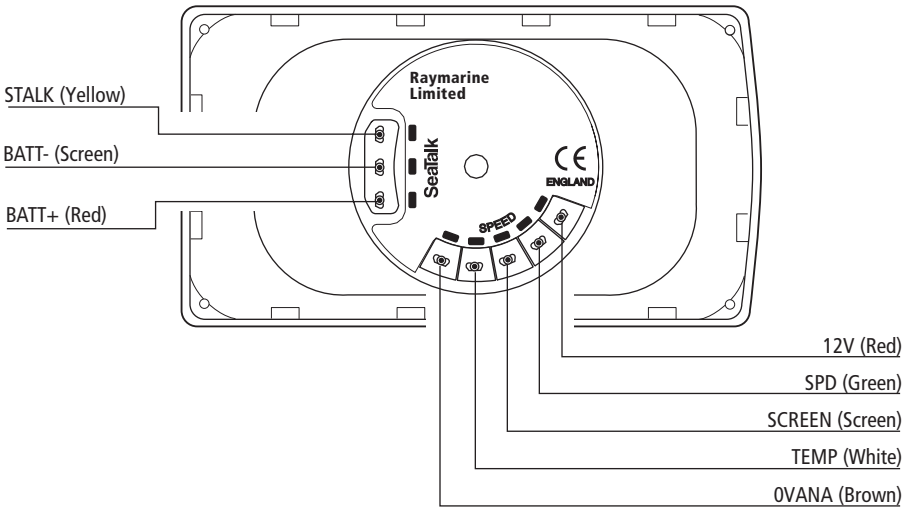
Chapter 1: ST40 Speed Instrument

Input/output signals



Connections to ST40 Speed instrument

Signal	Description
STALK	Intermittent streams of (nominal) 12 V pulses
BATT-	0 V
BATT+	Nominal 12 V dc supply
12V	Approximately 11.2 V dc out
SPD	With transducer attached, spinning paddle-wheel produces pulses approximately 11.2 V in amplitude @ 5.5 Hz/Knot.
SCREEN	0 V
TEMP	With transducer attached, voltage here is dependent on temperature. Approximately 1.8 V at 0 degrees C.
OVANA	0 V

Refer also to the *ST40 Speed circuit diagram*.

Self-testing

Each ST40 instrument has built-in self-test functions to aid fault diagnosis.

To self-test an ST40 Speed instrument:

- Press the ▲ and ⊙ keys simultaneously for 4 seconds, to access self-test mode, then within 2 seconds, press the ▲ and ▼ keys together momentarily, to start self-test stage 1.

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Self test stage 1

When entering self test stage 1, the instrument beeps and the display shows TEST 1, for 1 second. The following tests are then performed automatically:

- SeaTalk self test, which checks the receive and transmit circuits.
- EEPROM test (read and write).

If the tests are satisfactory, PASS is shown on the display.

If the tests are not satisfactory, the following failure codes may be generated:

Message	Failure	Action
FAIL 8	SeaTalk Rx/Tx	Check SeaTalk interface components around TR5
FAIL 18	EEPROM	Replace EEPROM (IC3)

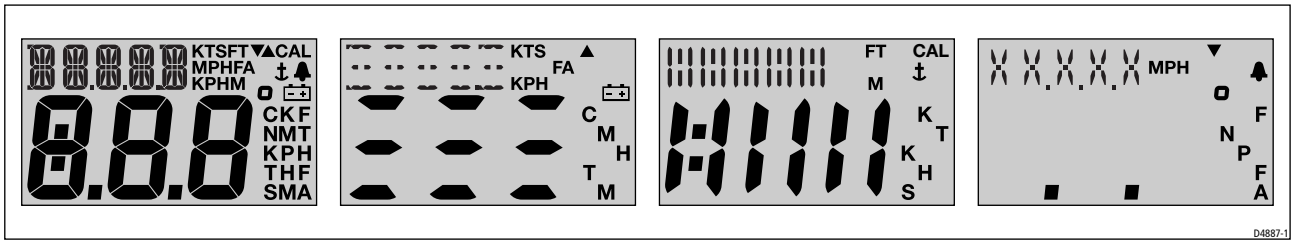
If there is no audible beep, check TR19(b) and RN3 and the buzzer for damage. If the beep volume is low, check R93.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 2.

Self-test stage 2

When entering self test stage 2, the instrument beeps and the display shows TEST 2, for 1 second. The following tests are then performed automatically:

- The display backlighting cycles between on and off every second.
- A display test is performed. The LCD segments are displayed in the following sequence, changing once per second:



While this test is progressing, press each of the front panel keys and check that the buzzer sounds as each key is pressed.

If any problems occur, use the following table as a guide to try to remedy the problem:

Failure	Action
No illumination	Check TR18 and associated components. Check all LEDs.
No beep when key pressed	Replace keyswitch.
LCD segment(s) missing completely	Check LCD pins for poor/dry joints. Check IC7 pins for poor/dry joints.
Faint LCD segments	Check LCD for short circuited pins. Check IC7 for short circuited pins. Check the contrast drive circuit around TR6.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 3.

Self-test stage 3

Note: *A known good speed transducer must be connected for this test.*

When entering self test stage 3, the instrument beeps and the display shows TEST3, for 1 second.

A transducer test then starts. Manually spin the paddle wheel within 15 seconds of starting this test.

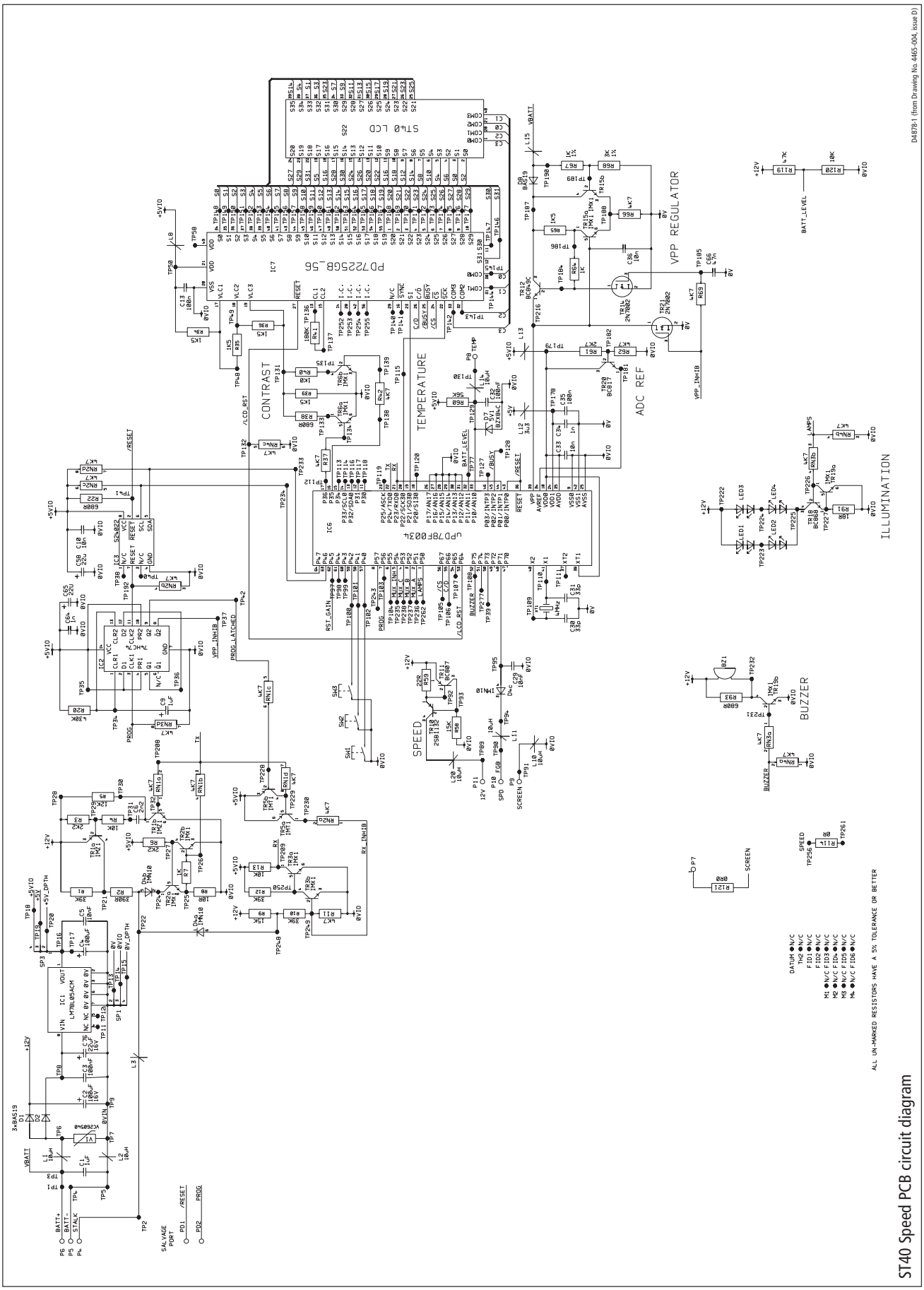
If the instrument detects valid temperature and speed pulses within 15 seconds of the start of test stage 3, PASS is shown on the display.

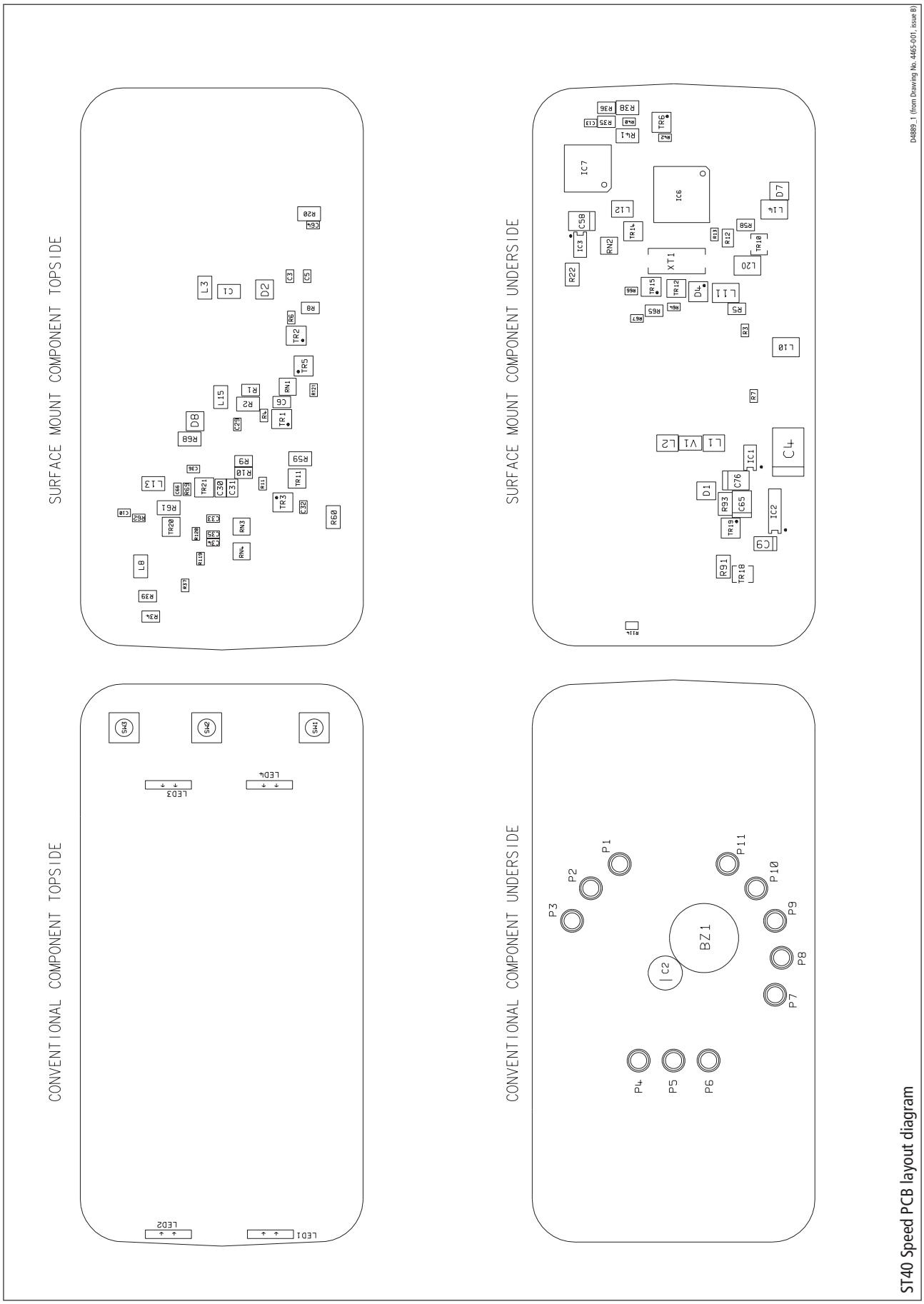
If the test fails, FAIL44 is displayed. Use the following table to try to isolate the cause.

Check	Failure mode	Action
Voltage at P11	Voltage approx. 11 V with 12 V battery supply	Check TR10, R59 and associated components.
L10	Open circuit	Replace L10.
L11	Open circuit	Replace L11.
D4c	Open circuit	Replace D4.
Voltage at TEMP pin	Outside range of 0.76 V to 1.00 V (at 18°C to 25°C)	Check L14 for open circuit. Check R60.
AVREF	Outside range of 2.5 V ±0.25 V	Check TR20, R61 & R62

Press the ▲ and ▼ keys together momentarily to exit self-test.

ST40 Speed PCB assembly





ST40 Speed PCB layout diagram

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ST40 Speed PCB assembly component list

Part No.	Description	Qty	Reference
03065	CAP 100uF 16V	1	C2
06030	ALPS TACT. SWITCH (RED)	3	SW1
			SW2
			SW3
15136	BUZZER EFM-250D	1	BZ1
15165	LED LTIF24-A2 GREEN	4	LED1
			LED2
			LED3
			LED4
4465-001SM	ST40 SPEED SM PCB ASSY	1	
3015-201-D	ST40 DIGITAL PCB	1	
91010R0	ZERO OHM LINK, 0603 PACKAGE	2	R114
			R121
910210R	RESISTOR 10 OHM 0805	1	R8
910212K	RESISTOR 12K+-5% 0805 0.1W	1	R5
910215K	RESISTOR 15K+-5% 0805 0.1W	2	R9
			R58
91021K5	RESISTOR 1K5+-5% 0805 0.1W	5	R39
			R34
			R35
			R36
			R65
910239K	RESISTOR 39K+-5% 0805 0.1W	3	R1
			R10
			R12
91033K	RESISTOR 3K0 1% 1206 1/8W	1	R68
9103430K	RESISTOR 430K, 1206	1	R20
9106180K	RESISTOR 180K, 1206	1	R41
910618R	RESISTOR 18 OHM +/-5% - 1206	1	R91
910622R	RESISTOR 22 OHM 1206	1	R59
91062K7	RESISTOR 2K7 OHM, 1206	1	R61
9106390R	RESISTOR 390R, 1206	1	R2
910656K	RESISTOR 56K, 1206	1	R60
9106680R	RESISTOR 680R, 1206	3	R22
			R38
			R93
9108VC260540	TRANSGUARD	1	V1
91124K7	RESISTOR NETWORK	4	RN1
			RN2
			RN3
			RN4
91AAAXXX10K	RESISTOR 10K,1% 0.063W 0603	3	R4
			R13
			R120

Part No.	Description	Qty	Reference
91AAAXXX1K0	RESISTOR 1.0K,1% 0.063W 0603	4	R7
			R40
			R64
			R67
91AAAXXX2K2	RESISTOR 2.2K,1% 0.063W 0603	2	R3
			R6
91AAAXXX47K	RESISTOR 47K,1% 0.063W 0603	1	R119
91AAAXXX4K7	RESISTOR 4.7K,1% 0.063W 0603	6	R11
			R37
			R42
			R62
			R69
			R66
9200BAS19	DIODE SOT23 BAS19	3	D1
			D2
			D8
9203BZX84C5V1	5V1 ZENER	1	D7
9206IMN10	TRIPLE DIODE ARRAY - ISOLATED	1	D4
930133P	CAPACITOR 33pF, 0805	2	C30
			C31
93091U	CAPACITOR 1uF, TANT	1	C9
9326100U	CAPACITOR 100uF 10V+-20% TANT	1	C4
93261U	CAPACITOR Y5V 1206 1uF 50V	1	C1
93ADEBXX47N	CAPACITOR 47nF, 0603	1	C66
93ADHBXX10N	CAPACITOR 10nF XR7	5	C5
			C10
			C29
			C33
			C36
93ADHBXX1N	CAPACITOR 1nF 0603	2	C34
			C64
93AFFDXX100N	CAPACITOR 100nF, 0603	4	C3
			C13
			C32
			C35
93BDHXXX2N2	CAP. 2n2, 0805 X7R	1	C6
93IDDCXX22U	CAP. 22uF TANT. ELECT	2	C58
			C65
93HDECXX22U	CAP. 22uF TANT. ELECT	1	C76
940024022	RESET CONTROLLER S24O22 +2KME	1	IC3
94007225GB	LCD DRIVER UPD7225GB-3B7 QFP	1	IC7
940074HC74	DUAL D-TYPE FLIP FLOP	1	IC2
940078F0034GK	FLASH MICRO UPD78FOO34AGK-8A8	1	IC6
9400LM78L05	VOLT REGULATOR LM78L05ACM	1	IC1
95002B1132	TRANSISTOR 2W PNP 2SB1132T100	1	TR10

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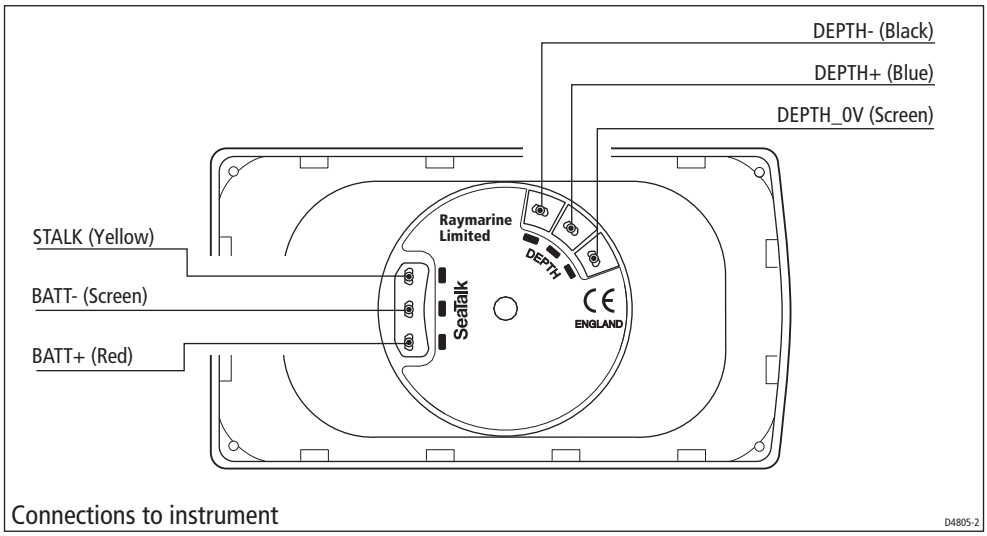
Part No.	Description	Qty	Reference
95002N7002	2N7002 MOSFET	2	TR14
			TR21
9500BC807	BC807	1	TR11
9500BC817	BC817	1	TR20
9500BC849C	BC 849C	1	TR12
9500IMT1	DUAL TRANSISTOR ARRAY	1	TR5
9500IMX1	DIGITAL TRANSISTOR ARRAY	5	TR2
			TR3
			TR6
			TR15
			TR19
9500IMZ1	DUAL TRANSISTOR ARRAY	1	TR1
9501BC868	BC868	1	TR18
96004MHZ	CRYSTAL 4.0MHz, HC49/4HSMX	1	XT1
9600L1	CHIP INDUCTOR	4	L3
			L8
			L13
			L15
9600L13	INDUCTOR, 3.3uH +/-20%	1	L12
9600L3	CHIP INDUCTOR, 10uH +/-20%	6	L1
			L2
			L10
			L11
			L14
			L20

Chapter 2: ST40 Depth Instrument

Input/output signals



Connections to instrument

Signal	Description
STALK	Intermittent streams of (nominal) 12 V pulses
BATT-	0 V
BATT+	Nominal 12 V dc supply
DEPTH-	Intermittent pulses at 200 kHz, approximately 400 µs wide, 300 V peak-to-peak
DEPTH+	Intermittent pulses at 200 kHz, approximately 400 µs wide, 300 V peak-to-peak
DEPTH_0V	0 V

Refer also to the *ST40 Depth circuit diagram*.

Self-test procedure

Each ST40 instrument has built-in self-test functions to aid fault diagnosis.

To self-test an ST40 Depth instrument:

- Press the ▲ and ⊙ keys simultaneously for 4 seconds, to access self-test mode, then within 2 seconds, press the ▲ and ▼ keys together momentarily, to start self-test stage 1.

Self test stage 1

When entering self test stage 1, the instrument beeps and the display shows TEST 1, for 1 second. The following tests are then performed automatically:

- SeaTalk self test, which checks the receive and transmit circuits.
- EEPROM test (read and write).

If the tests are satisfactory, PASS is shown on the display.

If the tests are not satisfactory, the following failure codes may be generated:

Message	Failure Mode	Action
FAIL 8	SeaTalk Rx/Tx	Check for damaged bucket connectors/rear-case pins. Check SeaTalk interface components around TR1, TR2 and TR3.
FAIL 18	EEPROM failure	Replace EEPROM (IC2)

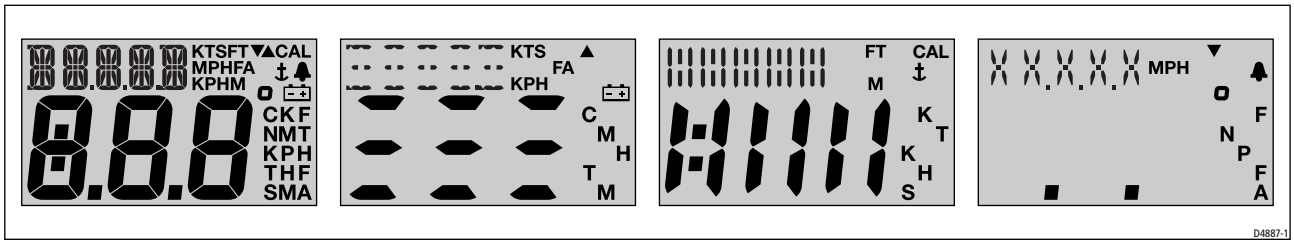
If there is no audible beep, check TR19(b) and RN3 and the buzzer for damage. If the beep volume is low, check R93.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 2.

Self-test stage 2

When entering self test stage 2, the instrument beeps and the display shows TEST 2, for 1 second. The following tests are then performed automatically:

- The display backlighting cycles between on and off every second.
- A display test is performed. The LCD segments are displayed in the following sequence, changing once per second:



While this test is progressing, press each of the front panel keys and check that the buzzer sounds as each key is pressed.

If any problems occur, use the following table as a guide to try to remedy the problem:

Failure	Action
No illumination	Check TR18 and associated components. Check all LEDs.
No beep when key pressed	Replace keyswitch.
LCD segment(s) missing completely	Check LCD pins for poor/dry joints. Check IC7 pins for poor/dry joints.
Faint LCD segments	Check LCD for short circuited pins. Check IC7 for short circuited pins. Check the contrast drive circuit around TR6.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 3.

Self-test stage 3

Note: *A known good depth transducer should be connected and placed in water, for this test. If this is not possible, an echo simulator can be used.*

When entering self test stage 3, the instrument beeps and the display shows TEST3, for 1 second.

A transducer test then starts. If the interface is working correctly, PASS is displayed.

If the test fails, FAIL 43 is displayed. Use the following table to try to isolate the cause.

Check	Failure mode	Action
Pulses at IC5, pins 1 & 4	No pulses	Check R113 Check IC5 and replace if suspect Check for dry joints at IC6 pins 46 & 49.
Pulses at TR4 drain	No pulses	Check R123
Pulses at TR8 drain	No pulses	Check R124
Pulses at DEPTH+ & DEPTH-	No pulses	Check TR4, TR8 & T1
Depth receiver output pulses at IC4, pin 14	No pulses	Return instrument to Raymarine Ltd.

Press the ▲ and ▼ keys together momentarily to exit self-test.

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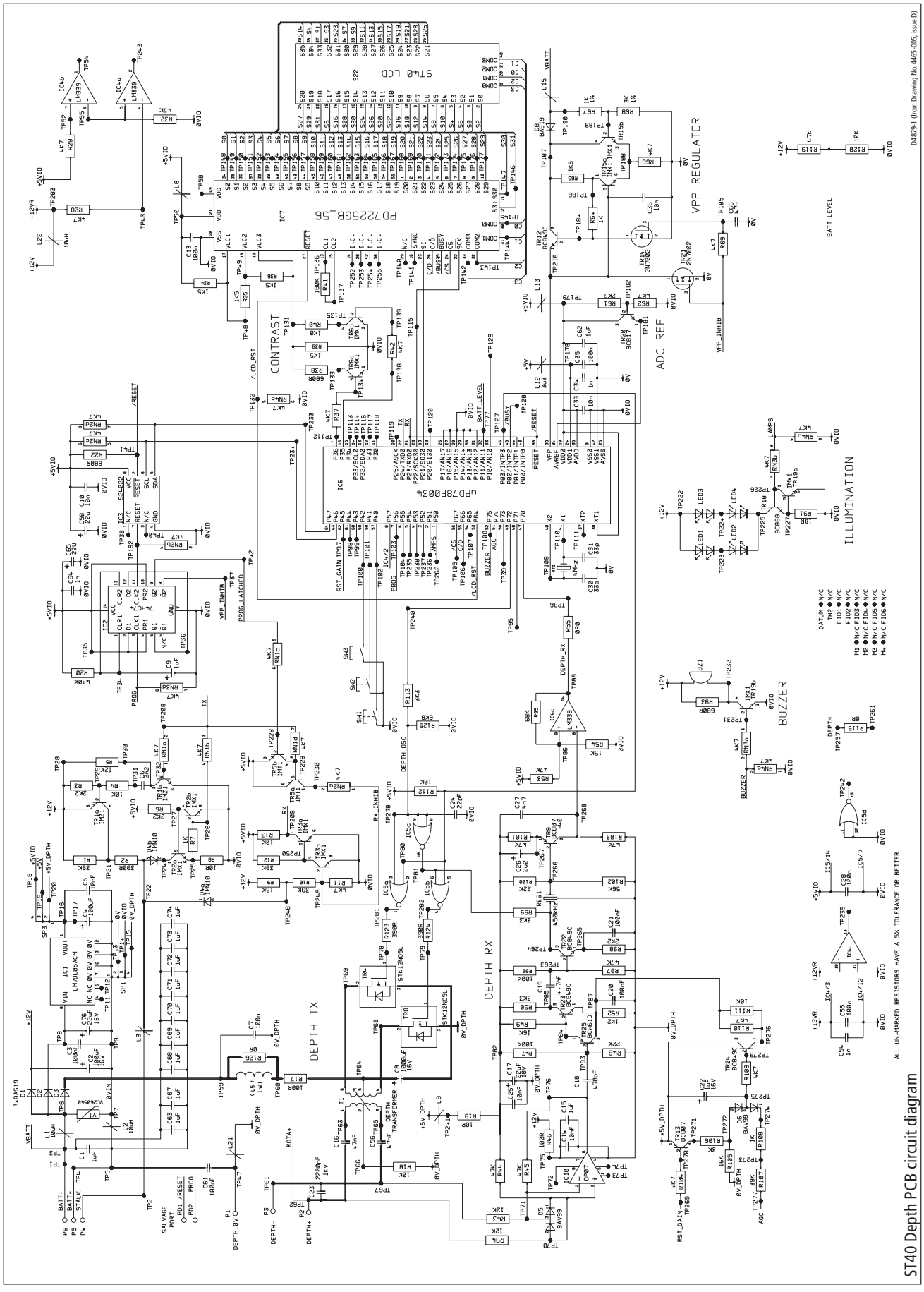
ST40 Depth PCB assembly



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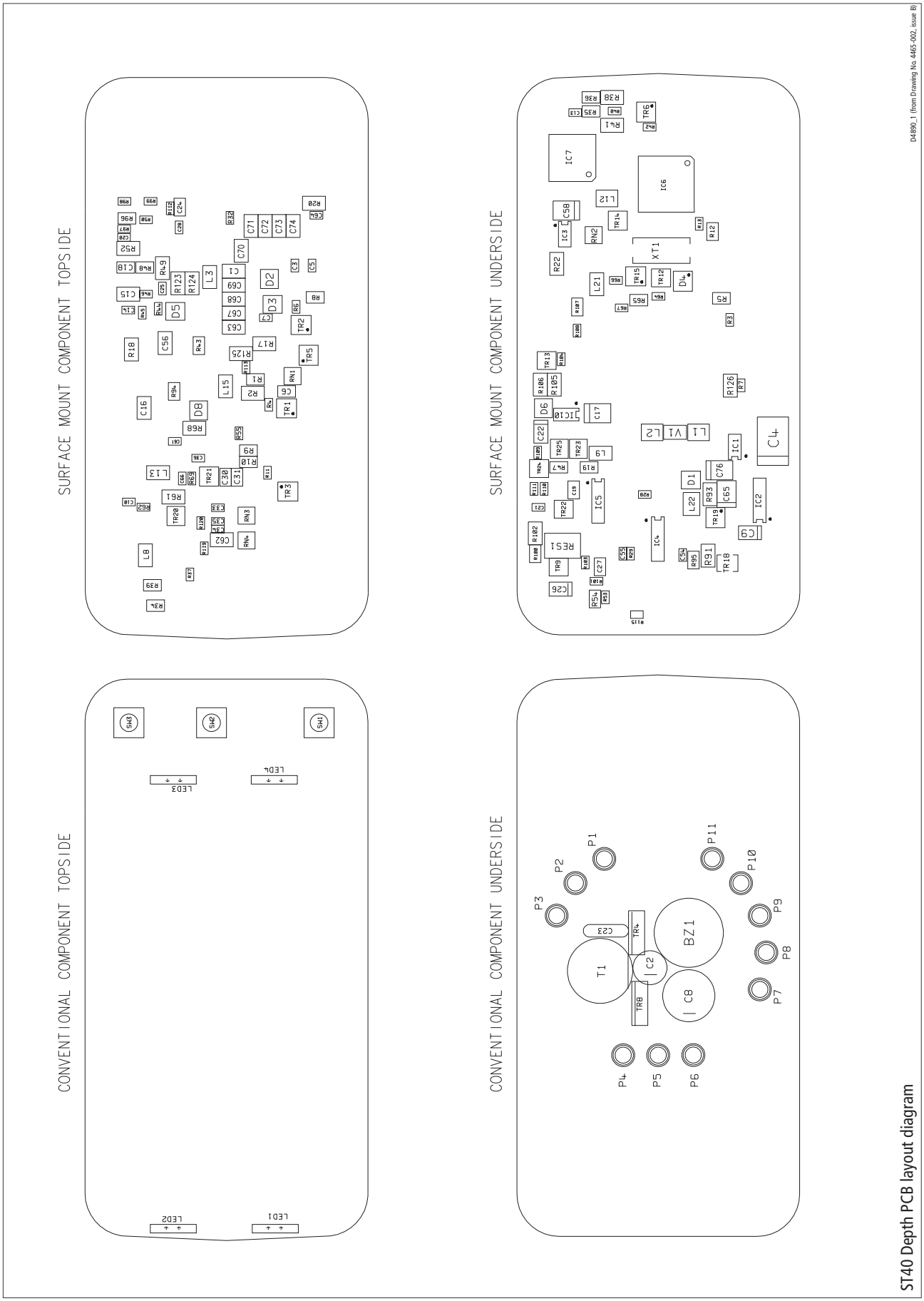

ST40 Depth PCB layout diagram

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ST40 Depth PCB assembly component list

Part No.	Description	Qty	Reference
03065	CAP 100uF 16V	1	C2
03066	CAP 1000uF 16V ELECT.	1	C8
03083	CAPACITOR 2200pF - 1kV	1	C23
06030	ALPS TACT. SWITCH (RED)	3	SW1
			SW2
			SW3
15134	XFORMER	1	T1
15136	BUZZER EFM-250D	1	BZ1
15165	LED LTIF24-A2 GREEN	4	LED1
			LED2
			LED3
			LED4
15172	F.E.T. STK 12N05L	2	TR4
			TR8
4465-002SM	ST40 DEPTH SM PCB ASSY	1	
3015-201-D	ST40 DIGITAL PCB	1	
91010R0	ZERO OHM LINK, 0603 PACKAGE	2	R55
			R115
9102100K	RESISTOR 100K+-5% 0805 0.1W	2	R47
			R96
910210R	RESISTOR 10 OHM 0805	2	R8
			R19
910212K	RESISTOR 12K+-5% 0805 0.1W	3	R5
			R43
			R94
910215K	RESISTOR 15K+-5% 0805 0.1W	2	R9
			R54
91021K5	RESISTOR 1K5+-5% 0805 0.1W	5	R34
			R35
			R36
			R39
			R65
910222K	RESISTOR 22K+-5% 0805 .1W	2	R48
			R100
910239K	RESISTOR 39K+-5% 0805 0.1W	4	R1
			R10
			R12
			R107
910268K	RESISTOR 68K+-5% 0805 0.1W	1	R95
9103100R	RESISTOR 100R, 1206	1	R17
910310K	RESISTOR, 10K 1% 1206	1	R18
91033K	RESISTOR 3K0 1% 1206 1/8W	2	R68
			R106

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Part No.	Description	Qty	Reference
9103430K	RESISTOR 430K, 1206	1	R20
91036K8	RESISTOR 6K8, 1206	1	R125
91060R0	RESISTOR 0R0, 1206	1	R126
910616K	RESISTOR 16K, 1206 0.1W	2	R49
			R105
9106180K	RESISTOR 180K, 1206	1	R41
910618R	RESISTOR 18 OHM +/-5% - 1206	1	R91
91061K2	RESISTOR 1K2, 1206	1	R52
91062K7	RESISTOR 2K7 OHM, 1206	1	R61
9106390R	RESISTOR 390R, 1206	3	R2
			R123
			R124
910656K	RESISTOR 56K, 1206	1	R102
9106680R	RESISTOR 680R, 1206	3	R22
			R38
			R93
9108VC260540	TRANSGUARD	1	V1
91124K7	RESISTOR NETWORK	4	RN1
			RN2
			RN3
			RN4
91AAAXX100R	RESISTOR 100R,1% 0.063W 0603	1	R46
91AAAXXX10K	RESISTOR 10K,1% 0.063W 0603	5	R4
			R13
			R111
			R112
			R120
91AAAXXX1K0	RESISTOR 1.0K,1% 0.063W 0603	5	R7
			R40
			R64
			R67
			R108
91AAAXXX2K2	RESISTOR 2.2K,1% 0.063W 0603	3	R3
			R6
			R98
91AAAXXX3K3	RESISTOR 3.3K,1% 0.063W 0603	3	R50
			R99
			R113
91AAAXXX47K	RESISTOR 47K,1% 0.063W 0603	8	R32
91AAAXXX47K	RESISTOR 47K,1% 0.063W 0603	8	R45
			R44
			R53
			R97
			R101
			R103
			R119

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Part No.	Description	Qty	Reference
91AAAXXX4K7	RESISTOR 4.7K,1% 0.063W 0603	11	R11
			R28
			R29
			R37
			R42
			R62
			R66
			R69
			R104
			R109
			R110
9200BAS19	DIODE SOT23 BAS19	4	D1
			D2
			D3
			D8
9200BAV99	BAV99 DIODE	2	D5
			D6
9206IMN10	TRIPLE DIODE ARRAY - ISOLATED	1	D4
930122P	CAPACITOR 22P, 0805	1	C24
930133P	CAPACITOR 33pF, 0805	2	C30
			C31
9301470P	CAPACITOR 470pf 100v +-5% 0805	1	C18
93060U047	CAPACITOR 0.047uF,	2	C16
			C56
93091U	CAPACITOR 1uF, TANT	2	C9
			C22
93102U2	CAPACITOR 2.2uF	1	C26
9326100U	CAPACITOR 100uF 10V+-20% TANTA	1	C4
93261U	CAPACITOR Y5V 1206 1uF 50V	12	C1
			C15
			C62
			C63
			C67
			C68
93261U	CAPACITOR Y5V 1206 1uF 50V	12	C69
			C70
			C71
			C72
			C73
			C74
93ADEBXX47N	CAPACITOR 47nF, 0603	1	C66

Part No.	Description	Qty	Reference
93ADHBXX10N	CAPACITOR 10nF XR7	6	C5
			C10
			C14
			C25
			C33
			C36
93ADHBXX1N	CAPACITOR 1nF 0603	3	C34
			C54
			C64
93AFFDXX100N	CAPACITOR 100nF, 0603	9	C3
			C7
			C13
			C20
			C21
			C28
			C35
			C55
			C61
93BDHXXX2N2	CAP. 2n2, 0805 X7R	1	C6
93BDHXXX4N7	CAP. 4n7, 0805 CERAMIC	1	C19
			C27
93IDDCXX22U	CAP. 22uF TANT. ELECT	3	C17
			C58
			C65
93HDECXX22U	CAP. 22uF TANT. ELECT	1	C76
940024022	RESET CONTROLLER S24O22 +2KMEM	1	IC3
94007225GB	LCD DRIVER UPD7225GB-3B7 QFP	1	IC7
940074AHC02	IC LOGIC	1	IC5
940074HC74	DUAL D-TYPE FLIP FLOP	1	IC2
940078F0034GK	FLASH MICRO UPD78FOO34AGK-8A8	1	IC6
9400LM339	QUAD OP AMP	1	IC4
9400LM78L05	VOLT REGULATOR LM78L05ACM	1	IC1
9400TIOP07C	OP07C OP-AMP	1	IC10
95002N7002	2N7002 MOSFET	2	TR14
95002N7002	2N7002 MOSFET	2	TR21
9500BC807	BC807	2	TR9
			TR13
9500BC817	BC817	1	TR20
9500BC849C	BC 849C	4	TR12
			TR22
			TR23
			TR24

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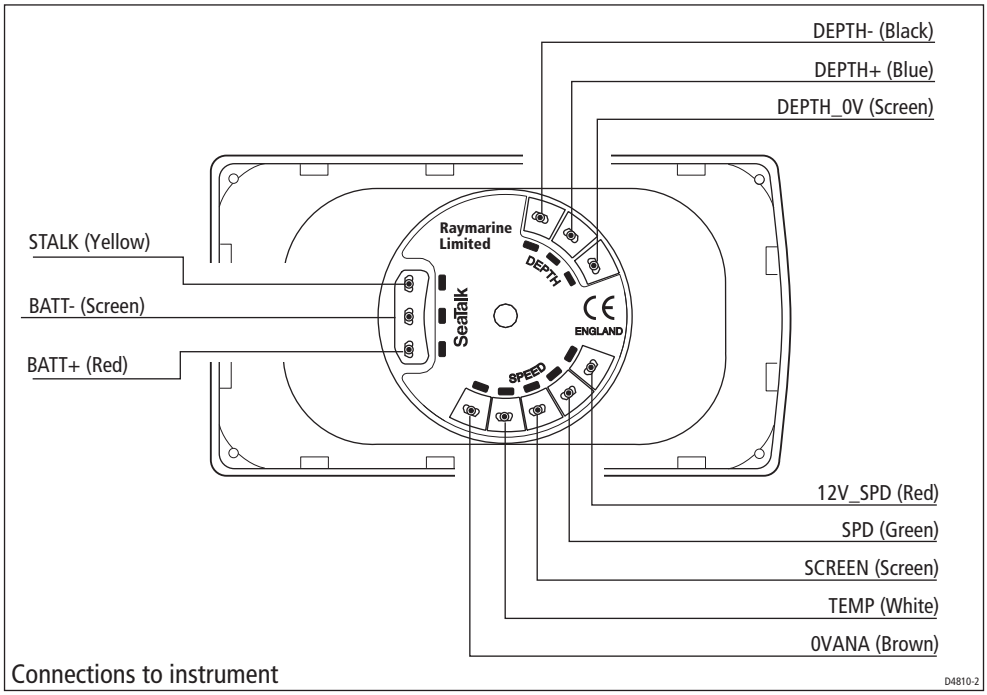
Part No.	Description	Qty	Reference
9500BCW61D	BCW61D	1	TR25
9500IMT1	DUAL TRANSISTOR ARRAY	1	TR5
9500IMX1	DIGITAL TRANSISTOR ARRAY	5	TR2
			TR3
			TR6
			TR15
			TR19
9500IMZ1	DUAL TRANSISTOR ARRAY	1	TR1
9501BC868	BC868	1	TR18
96004MHZ	CRYSTAL 4.0MHz, HC49/4HSMX	1	XT1
9600FILTER1	CERAMIC FILTER	1	RES1
9600L1	CHIP INDUCTOR	6	L3
			L8
			L9
			L13
			L15
			L21
9600L13	INDUCTOR, 3.3uH +/-20%	1	L12
9600L3	CHIP INDUCTOR, 10uH +/-20%	3	L1
			L2
			L22

Chapter 3: ST40 Bidata Instrument

Input/output signals



Connections to instrument

Signal	Description
STALK	Intermittent streams of (nominal) 12 V pulses
BATT-	0 V
BATT+	Nominal 12 V dc supply
DEPTH-	Intermittent pulses at 200 kHz, approximately 400 µs wide, 300 V peak-to-peak
DEPTH+	Intermittent pulses at 200 kHz, approximately 400 µs wide, 300 V peak-to-peak
DEPTH_0V	0 V
12V	Approximately 11.2 V dc out
SPD	With transducer attached, spinning paddle-wheel produces pulses approximately 11.2 V in amplitude @ 5.5 Hz/Knot.
SCREEN	0 V
TEMP	With transducer attached, voltage here is dependent on temperature. Approximately 1.8 V at 0 degrees C.
0VANA	0 V

Refer also to the *ST40 Bidata circuit diagram*.

Self-test procedure

Each ST40 instrument has built-in self-test functions to aid fault diagnosis.

To self-test an ST40 Bidata instrument:

- Press the ▲ and ⊙ keys simultaneously for 4 seconds, to access self-test mode, then within 2 seconds, press the ▲ and ▼ keys together momentarily, to start self-test stage 1.

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Self test stage 1

When entering self test stage 1, the instrument beeps and the display shows TEST 1, for 1 second. The following tests are then performed automatically:

- SeaTalk self test, which checks the receive and transmit circuits.
- EEPROM test (read and write).

If the tests are satisfactory, PASS is shown on the display.

If the tests are not satisfactory, the following failure codes may be generated:

Message	Failure Mode	Action
FAIL 8	SeaTalk Rx/Tx	Check for damaged bucket connectors/rear-case pins. Check SeaTalk interface components around TR1, TR2 and TR3.
FAIL 18	EEPROM failure	Replace EEPROM (IC2)

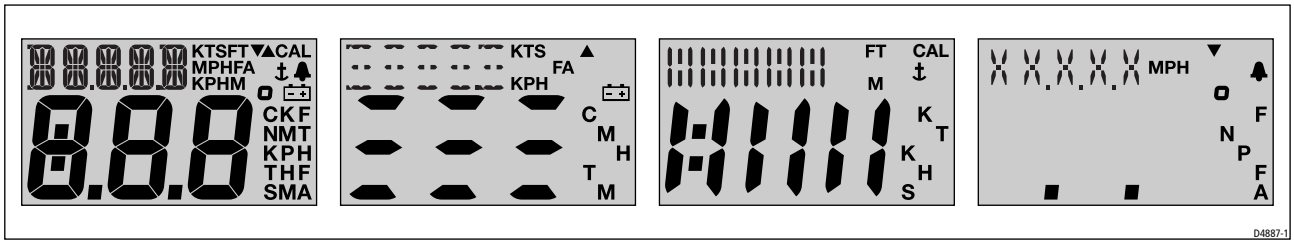
If there is no audible beep, check TR19(b) and RN3 and the buzzer for damage. If the beep volume is low, check R93.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 2.

Self-test stage 2

When entering self test stage 2, the instrument beeps and the display shows TEST 2, for 1 second. The following tests are then performed automatically:

- The display backlighting cycles between on and off every second.
- A display test is performed. The LCD segments are displayed in the following sequence, changing once per second:



While this test is progressing, press each of the front panel keys and check that the buzzer sounds as each key is pressed.

If any problems occur, use the following table as a guide to try to remedy the problem:

Failure	Action
No illumination	Check TR18 and associated components. Check all LEDs.
No beep when key pressed	Replace keyswitch.
LCD segment(s) missing completely	Check LCD pins for poor/dry joints. Check IC7 pins for poor/dry joints.
Faint LCD segments	Check LCD for short circuited pins. Check IC7 for short circuited pins. Check the contrast drive circuit around TR6.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 3.

Self-test stage 3

Note: *Known good Speed and Depth transducers must be connected, for this test, with the Depth transducer placed in water. If this is not possible, an echo simulator can be used in place of the Depth transducer.*

When entering self test stage 3, the instrument beeps and the display shows TEST3, for 1 second.

A transducer test then starts. At the Speed transducer, manually spin the paddle wheel within 15 seconds of starting this test.

If the instrument detects valid temperature and speed pulses within 15 seconds of the start of test stage 4 and if the Depth transducer interface is satisfactory, PASS is shown on the display.

If the test fails, either a FAIL44 (speed circuit) or FAIL43 (depth circuit) is indicated. Use the appropriate table in either *Chapter 1, ST40 Speed Instrument* or *Chapter 2, ST40 Depth Instrument*, to isolate the cause.

Press the ▲ and ▼ keys together momentarily to exit self-test.

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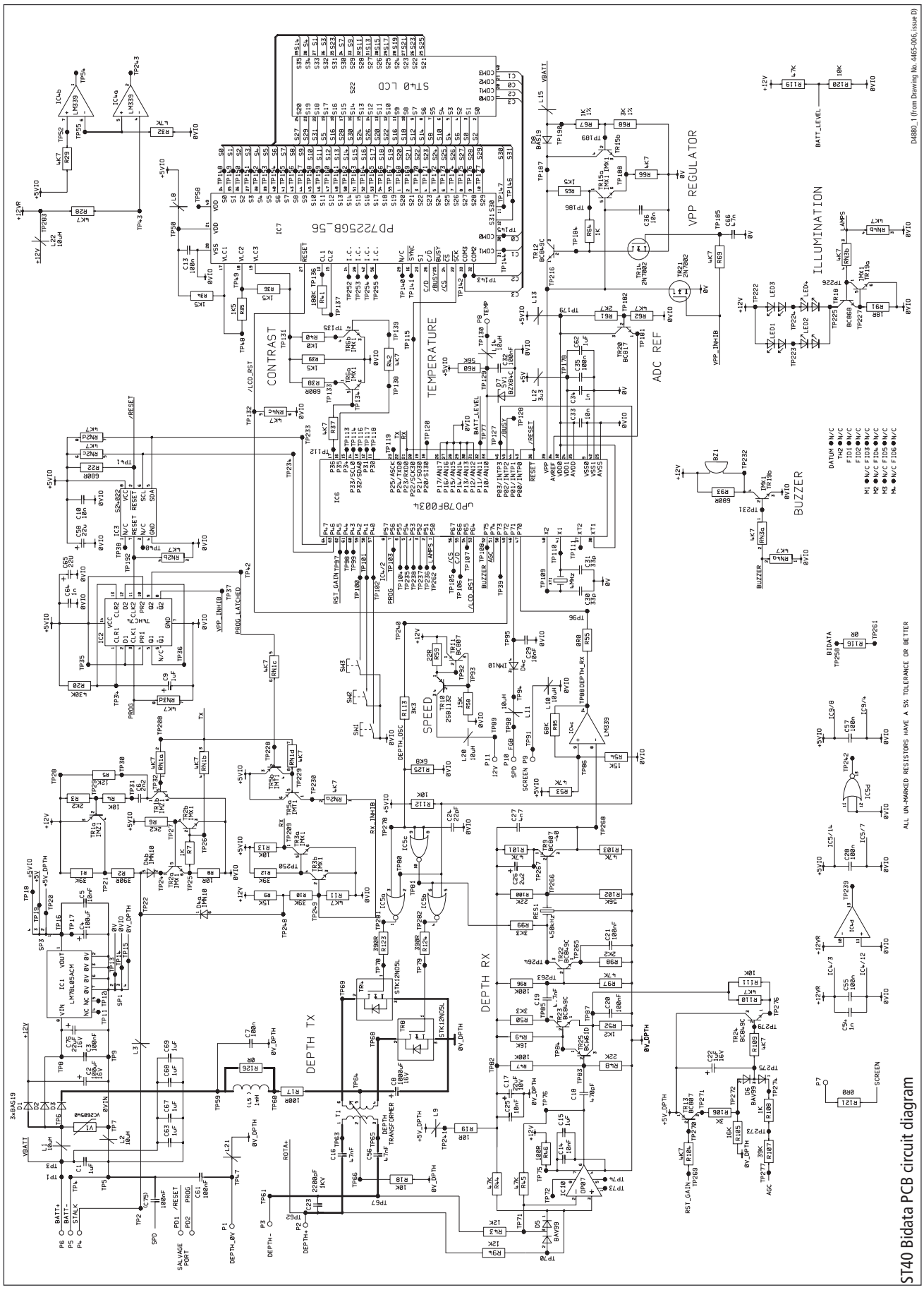
ST40 Bidata PCB assembly



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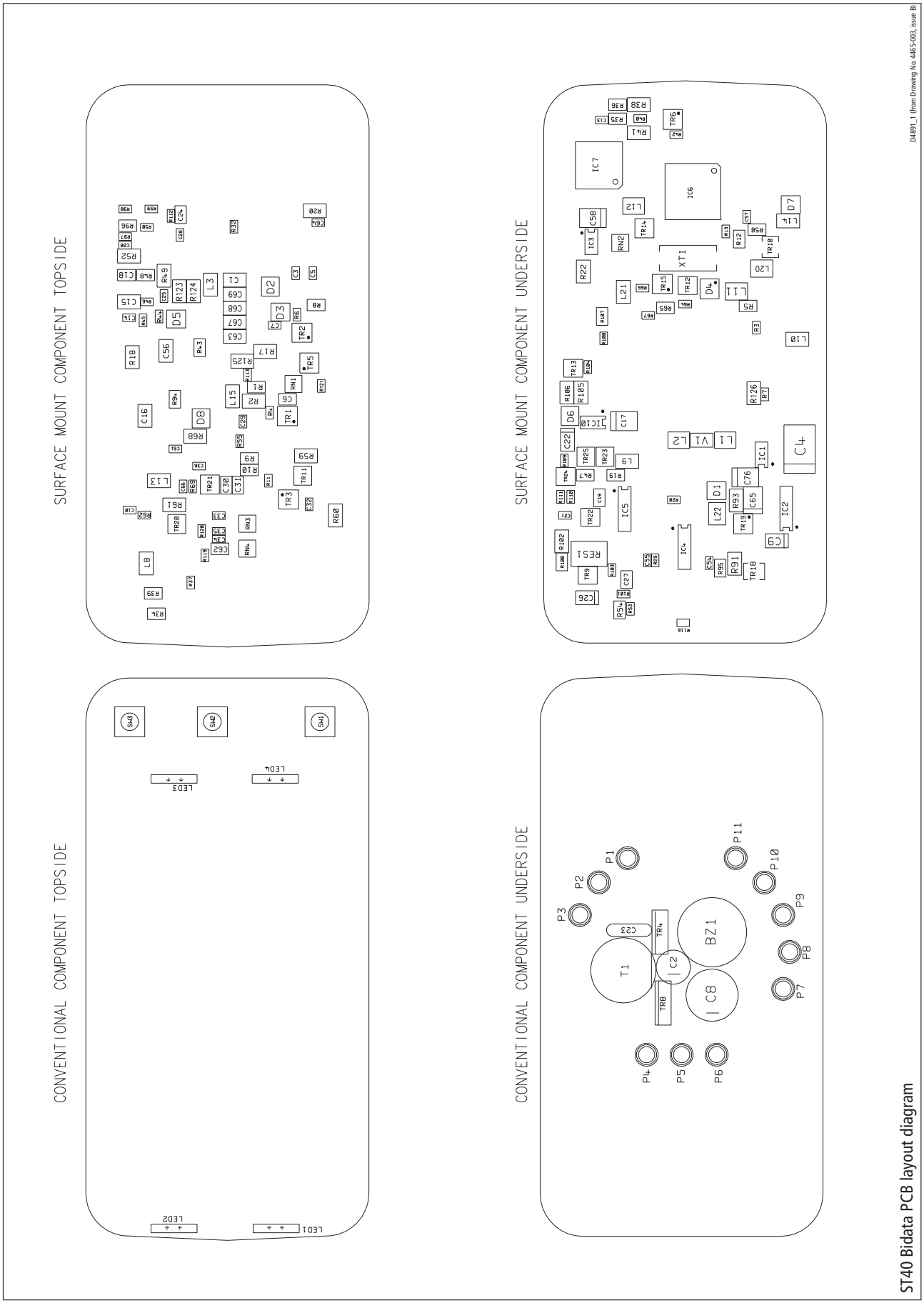

ST40 Bidata PCB layout diagram

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ST40 Bidata PCB assembly component list

Part No.	Description	Qty	Reference
03065	CAP 100uF 16V	1	C2
03066	CAP 1000uF 16V ELECT.	1	C8
03083	CAPACITOR 2200pF - 1kV	1	C23
06030	ALPS TACT. SWITCH (RED)	3	SW1
			SW2
			SW3
15134	XFORMER	1	T1
15136	BUZZER EFM-250D	1	BZ1
15165	LED LTIF24-A2 GREEN	4	LED1
			LED2
			LED3
			LED4
15172	F.E.T. STK 12N05L	2	TR4
			TR8
4465-003SM	ST40 BIDATA SM PCB ASSY	1	
3015-201-D	ST40 DIGITAL PCB	1	
91010R0	ZERO OHM LINK, 0603 PACKAGE	3	R55
			R116
			R121
9102100K	RESISTOR 100K+-5% 0805 0.1W	2	R47
			R96
910210R	RESISTOR 10 OHM 0805	2	R8
			R19
910212K	RESISTOR 12K+-5% 0805 0.1W	3	R5
			R43
			R94
910215K	RESISTOR 15K+-5% 0805 0.1W	3	R9
			R54
			R58
91021K5	RESISTOR 1K5+-5% 0805 0.1W	5	R39
			R34
			R35
			R36
			R65
910222K	RESISTOR 22K+-5% 0805 .1W	2	R48
			R100
910239K	RESISTOR 39K+-5% 0805 0.1W	4	R1
			R10
			R12
			R107
910268K	RESISTOR 68K+-5% 0805 0.1W	1	R95
9103100R	RESISTOR 100R, 1206	1	R17
910310K	RESISTOR, 10K 1% 1206	1	R18

Part No.	Description	Qty	Reference
91033K	RESISTOR 3K0 1% 1206 1/8W	2	R68
			R106
9103430K	RESISTOR 430K, 1206	1	R20
91036K8	RESISTOR 6K8, 1206	1	R125
91060R0	RESISTOR 0R0, 1206	1	R126
910616K	RESISTOR 16K, 1206 0.1W	2	R49
			R105
9106180K	RESISTOR 180K, 1206	1	R41
910618R	RESISTOR 18 OHM +/-5% - 1206	1	R91
91061K2	RESISTOR 1K2, 1206	1	R52
910622R	RESISTOR 22 OHM 1206	1	R59
91062K7	RESISTOR 2K7 OHM, 1206	1	R61
9106390R	RESISTOR 390R, 1206	3	R2
			R123
			R124
910656K	RESISTOR 56K, 1206	2	R60
			R102
9106680R	RESISTOR 680R, 1206	3	R22
			R38
			R93
9108VC260540	TRANSGUARD	1	V1
91124K7	RESISTOR NETWORK	4	RN1
			RN2
			RN3
			RN4
91AAAXX100R	RESISTOR 100R,1% 0.063W 0603	1	R46
91AAAXXX10K	RESISTOR 10K,1% 0.063W 0603	5	R4
			R13
			R111
			R112
			R120
91AAAXXX1K0	RESISTOR 1.0K,1% 0.063W 0603	5	R7
			R40
			R64
			R67
			R108
91AAAXXX2K2	RESISTOR 2.2K,1% 0.063W 0603	3	R3
			R6
			R98
91AAAXXX3K3	RESISTOR 3.3K,1% 0.063W 0603	3	R50
			R99
			R113

Part No.	Description	Qty	Reference
91AAAXXX47K	RESISTOR 47K,1% 0.063W 0603	8	R32
			R44
			R45
			R53
			R97
			R101
			R103
			R119
91AAAXXX4K7	RESISTOR 4.7K,1% 0.063W 0603	11	R11
			R28
			R29
			R37
			R42
			R62
			R66
			R69
			R104
			R109
			R110
9200BAS19	DIODE SOT23 BAS19	4	D1
			D2
			D3
			D8
9200BAV99	BAV99 DIODE	2	D5
			D6
9203BZX84C5V1	5V1 ZENER	1	D7
9206IMN10	TRIPLE DIODE ARRAY - ISOLATED	1	D4
930122P	CAPACITOR 22P, 0805	1	C24
930133P	CAPACITOR 33pF, 0805	2	C30
			C31
9301470P	CAPACITOR 470pf 100v +-5% 0805	1	C18
93060U047	CAPACITOR 0.047uF,	2	C16
			C56
93091U	CAPACITOR 1uF, TANT	2	C9
			C22
93102U2	CAPACITOR 2.2uF	1	C26
9326100U	CAPACITOR 100uF 10V+-20% TANTA	1	C4
93261U	CAPACITOR Y5V 1206 1uF 50V	7	C1
93261U	CAPACITOR Y5V 1206 1uF 50V	7	C15
			C62
			C63
			C67
			C68
			C69
93ADEBXX47N	CAPACITOR 47nF, 0603	1	C66

Part No.	Description	Qty	Reference
93ADHBXX10N	CAPACITOR 10nF XR7	7	C5
			C10
			C14
			C25
			C29
			C33
			C36
93ADHBXX1N	CAPACITOR 1nF 0603	3	C34
			C54
			C64
93AFFDXX100N	CAPACITOR 100nF, 0603	11	C3
			C7
			C13
			C20
			C21
			C28
			C32
			C35
			C55
			C57
			C61
93BDHXXX2N2	CAP. 2n2, 0805 X7R	1	C6
93BDHXXX4N7	CAP. 4n7, 0805 CERAMIC	2	C19
			C27
93IDDCXX22U	CAP. 22uF TANT. ELECT	3	C17
			C58
			C65
93HDECXX22U	CAP. 22uF TANT. ELECT	1	C76
940024022	RESET CONTROLLER S24O22 +2KMEM	1	IC3
94007225GB	LCD DRIVER UPD7225GB-3B7 QFP	1	IC7
940074AHC02	IC LOGIC	1	IC5
940074HC74	DUAL D-TYPE FLIP FLOP	1	IC2
940078F0034GK	FLASH MICRO UPD78FOO34AGK-8A8	1	IC6
9400LM339	QUAD OP AMP	1	IC4
9400LM78L05	VOLT REGULATOR LM78L05ACM	1	IC1
9400TIOP07C	OP07C OP-AMP	1	IC10
95002B1132	TRANSISTOR 2W PNP 2SB1132T100Q	1	TR10
95002N7002	2N7002 MOSFET	2	TR14
			TR21
9500BC807	BC807	3	TR9
			TR11
			TR13
9500BC817	BC817	1	TR20

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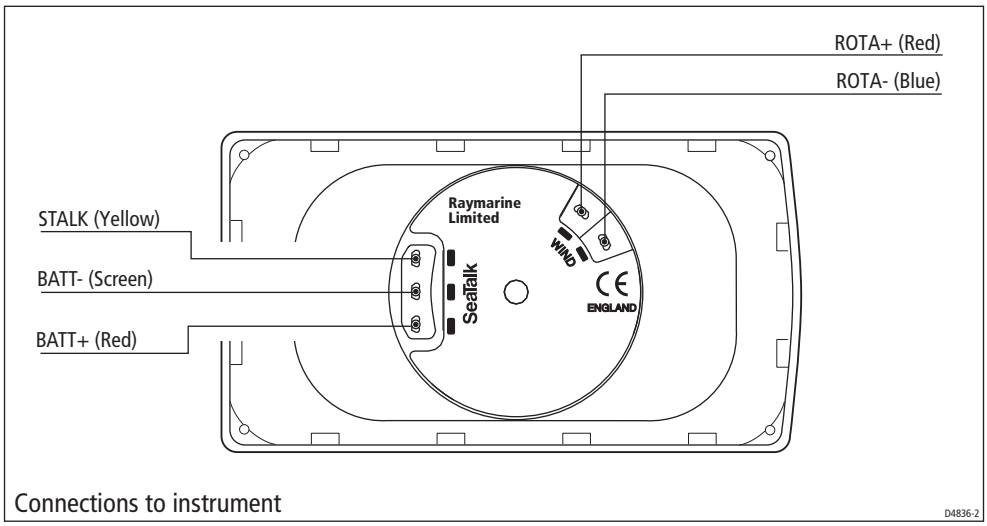
Part No.	Description	Qty	Reference
9500BC849C	BC 849C	4	TR12
			TR22
			TR23
			TR24
9500BCW61D	BCW61D	1	TR25
9500IMT1	DUAL TRANSISTOR ARRAY	1	TR5
9500IMX1	DIGITAL TRANSISTOR ARRAY	5	TR2
			TR3
			TR6
			TR15
			TR19
9500IMZ1	DUAL TRANSISTOR ARRAY	1	TR1
9501BC868	BC868	1	TR18
96004MHZ	CRYSTAL 4.0MHz, HC49/4HSMX	1	XT1
9600FILTER1	CERAMIC FILTER	1	RES1
9600L1	CHIP INDUCTOR	6	L3
			L8
			L9
			L13
			L15
			L21
9600L13	INDUCTOR, 3.3uH +/-20%	1	L12
9600L3	CHIP INDUCTOR, 10uH +/-20%	7	L1
			L2
			L10
			L11
			L14
			L20
			L22

Chapter 4: ST40 Wind Instrument

Input/output signals



Connections to instrument

Signal	Description
STALK	Intermittent streams of (nominal) 12 V pulses
BATT-	0 V
BATT+	Nominal 12 V dc supply
ROTA+	Rotavecta current constant
ROTA-	0 V

Refer also to the *ST40 Wind circuit diagram*.

Self-test procedure

Each ST40 instrument has built-in self-test functions to aid fault diagnosis.

To self-test an ST40 Wind instrument:

- Press the ▲ and ⊙ keys simultaneously for 4 seconds, to access self-test mode, then within 2 seconds, press the ▲ and ▼ keys together momentarily, to start self-test stage 1.

Self test stage 1

When entering self test stage 1, the instrument beeps and the display shows TEST 1, for 1 second. The following tests are then performed automatically:

- SeaTalk self test, which checks the receive and transmit circuits.
- EEPROM test (read and write).

If the tests are satisfactory, PASS is shown on the display.

If the tests are not satisfactory, the following failure codes may be generated:

Message	Failure Mode	Action
FAIL 8	SeaTalk Rx/Tx	Check for damaged bucket connectors/rear-case pins. Check SeaTalk interface components around TR1, TR2 and TR3.
FAIL 18	EEPROM failure	Replace EEPROM (IC2)

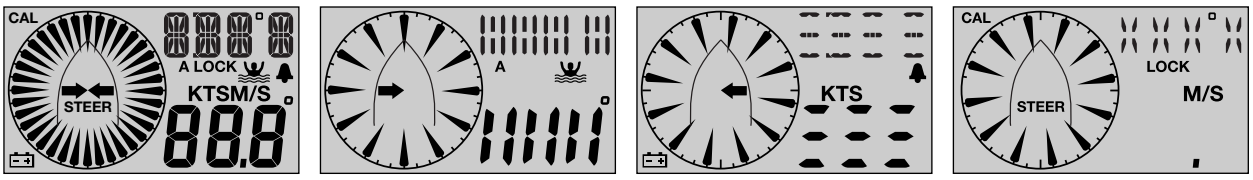
If there is no audible beep, check TR19(b) and RN3 and the buzzer for damage. If the beep volume is low, check R93.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 2.

Self-test stage 2

When entering self test stage 2, the instrument beeps and the display shows TEST 2, for 1 second. The following tests are then performed automatically:

- The display backlighting cycles between on and off every second.
- A display test is performed. The LCD segments are displayed in the following sequence, changing once per second:



While this test is progressing, press each of the front panel keys and check that the buzzer sounds as each key is pressed.

If any problems occur, use the following table as a guide to try to remedy the problem:

Failure	Action
No illumination	Check TR18 and associated components. Check all LEDs.
No beep when key pressed	Replace keyswitch.
LCD segment(s) missing completely	Check LCD pins for poor/dry joints. Check IC7 pins for poor/dry joints.
Faint LCD segments	Check LCD for short circuited pins. Check IC7 for short circuited pins. Check the contrast drive circuit around TR6.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 3.

Self-test stage 3

Note: *A known good Rotavecta transducer must be connected, for this test.*

When entering self test stage 3, the instrument beeps and the display shows TEST3, for 1 second.

A transducer test then starts. Within the next 15 seconds, manually spin the Rotavecta cups, so they rotate at approximately 20 rpm, or faster.

If the instrument detects a sufficient number of Rotavecta pulses, PASS is shown on the display.

If the test fails, FAIL 36 is displayed. Use the following table to try to isolate the cause.

Check	Failure mode	Action
Rotate Rotavecta cups and check that the voltage at P2 switches between approx 3 V and 8 V	Voltage not switching	Check constant current at P2 is approx 10 mA Check that P1 is at 0 V Check L7 is not open circuit.
Check Rotavecta pulses at IC4, pin1	No pulses	Check IC4 and associated components
Check ROTAPRESS at IC4, pin 2 is high.	ROTAPRESS low	Check IC4 and associated components.

Press the ▲ and ▼ keys together momentarily to exit self-test.

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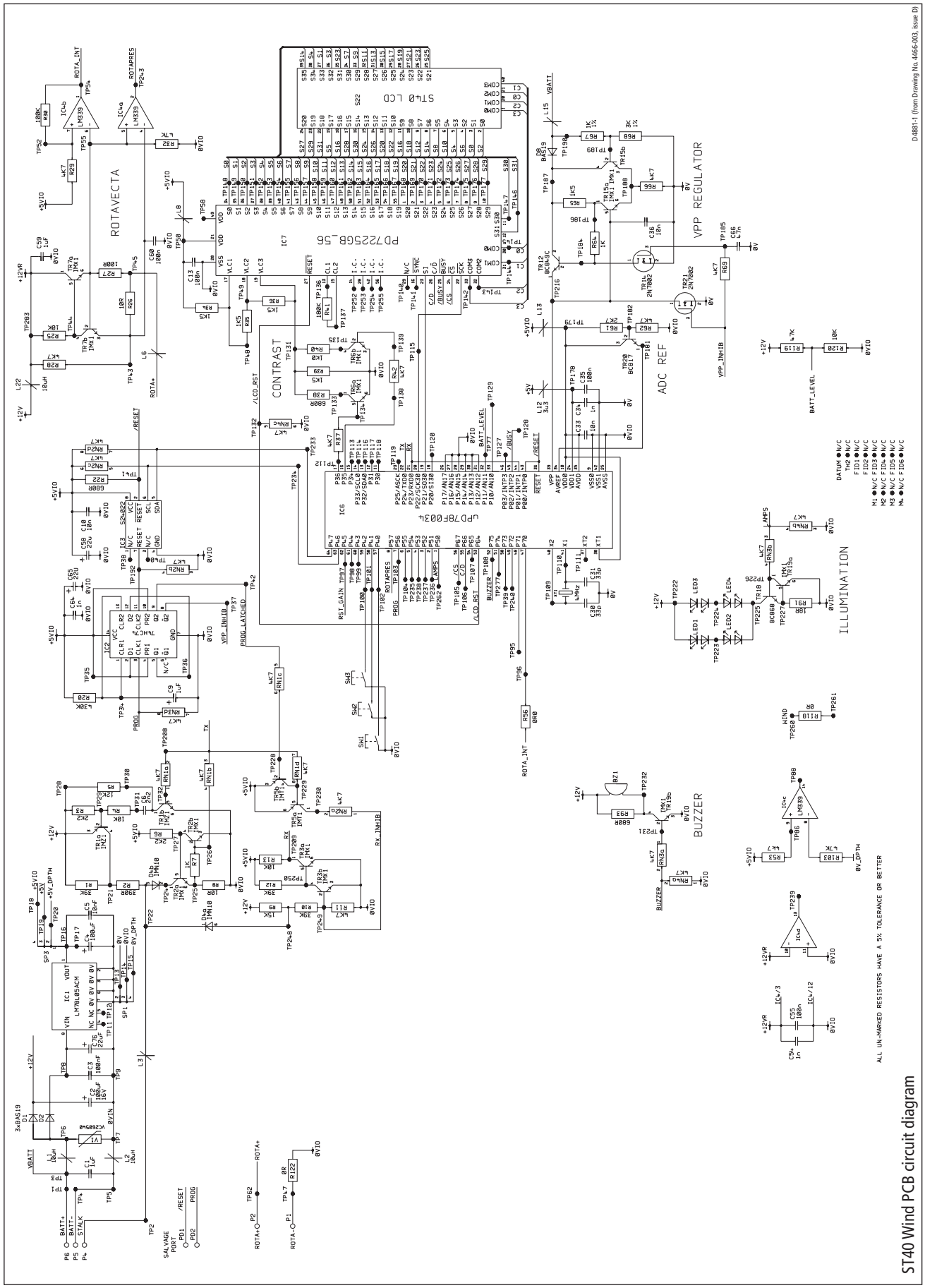
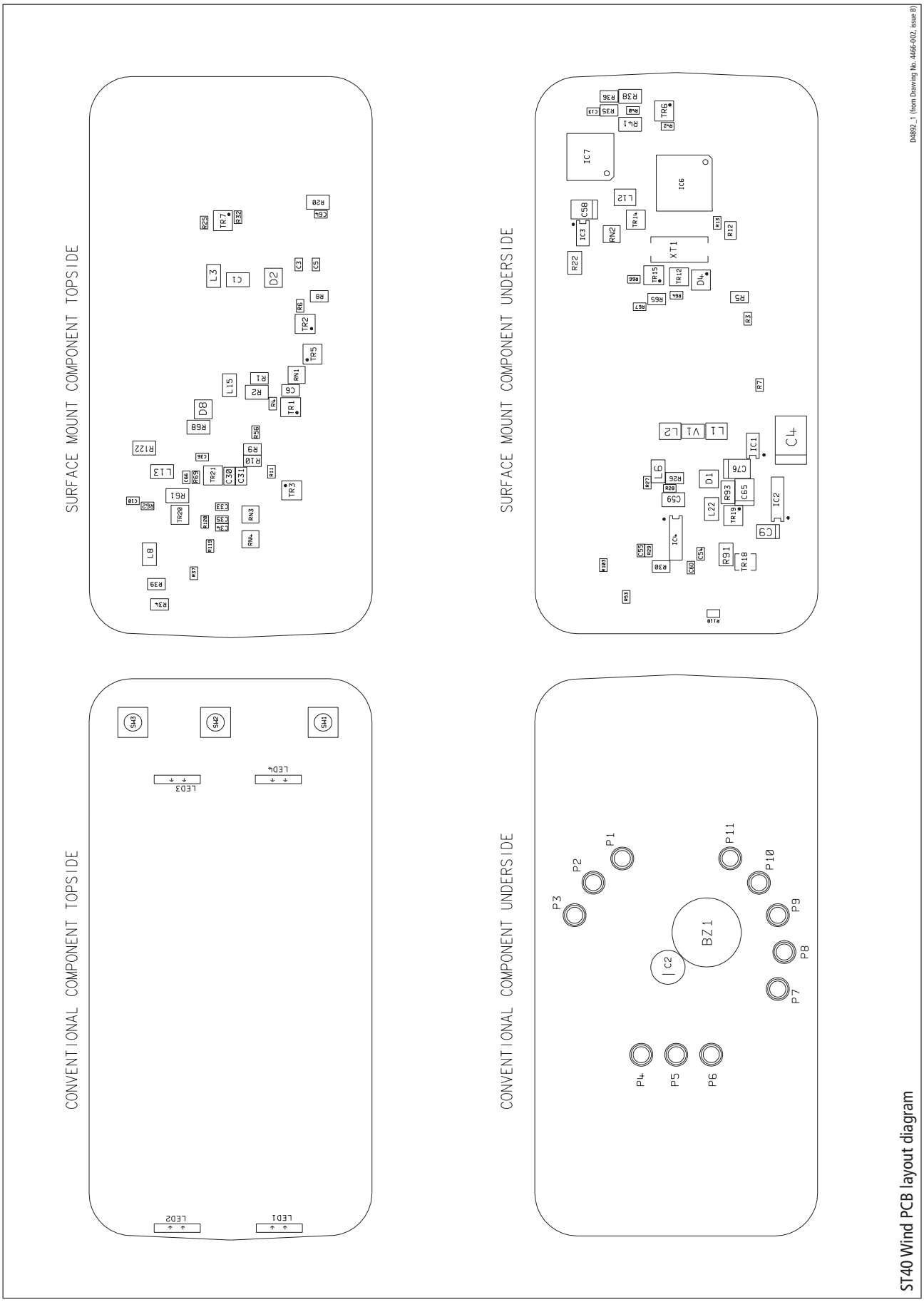
ST40 Wind PCB assembly





ST40 Wind PCB layout diagram

E22041

ST40 Wind PCB assembly component list

Part No.	Description	Qty	Reference
03065	CAP 100uF 16V	1	C2
06030	ALPS TACT. SWITCH (RED)	3	SW1
			SW2
			SW3
15136	BUZZER EFM-250D	1	BZ1
15165	LED LTIF24-A2 GREEN	4	LED1
			LED2
			LED3
			LED4
4466-002SM	ST40 WIND SM PCB ASSY	1	
3015-201-D	ST40 DIGITAL PCB	1	
91010R0	ZERO OHM LINK, 0603 PACKAGE	2	R56
			R118
9102100K	RESISTOR 100K+-5% 0805 0.1W	1	R30
910210R	RESISTOR 10 OHM 0805	2	R8
			R26
910212K	RESISTOR 12K+-5% 0805 0.1W	1	R5
910215K	RESISTOR 15K+-5% 0805 0.1W	1	R9
91021K5	RESISTOR 1K5+-5% 0805 0.1W	5	R39
			R34
			R35
			R36
			R65
910239K	RESISTOR 39K+-5% 0805 0.1W	3	R1
			R10
			R12
91033K	RESISTOR 3K0 1% 1206 1/8W	1	R68
9103430K	RESISTOR 430K, 1206	1	R20
91060R0	RESISTOR 0R0, 1206	1	R122
9106180K	RESISTOR 180K, 1206	1	R41
910618R	RESISTOR 18 OHM +/-5% - 1206	1	R91
91062K7	RESISTOR 2K7 OHM, 1206	1	R61
9106390R	RESISTOR 390R, 1206	1	R2
9106680R	RESISTOR 680R, 1206	3	R22
			R38
			R93
9108VC260540	TRANSGUARD	1	V1
91124K7	RESISTOR NETWORK	4	RN1
			RN2
			RN3
			RN4
91AAAXX100R	RESISTOR 100R,1% 0.063W 0603	1	R27

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Part No.	Description	Qty	Reference
91AAAXXX10K	RESISTOR 10K,1% 0.063W 0603	4	R4
			R13
			R25
			R120
91AAAXXX1K0	RESISTOR 1.0K,1% 0.063W 0603	4	R7
			R40
			R64
			R67
91AAAXXX2K2	RESISTOR 2.2K,1% 0.063W 0603	2	R3
			R6
91AAAXXX47K	RESISTOR 47K,1% 0.063W 0603	2	R32
			R119
91AAAXXX4K7	RESISTOR 4.7K,1% 0.063W 0603	10	R11
			R28
			R29
			R37
			R42
			R53
			R62
			R66
			R69
			R103
9200BAS19	DIODE SOT23 BAS19	3	D1
			D2
			D8
9206IMN10	TRIPLE DIODE ARRAY - ISOLATED	1	D4
930133P	CAPACITOR 33pF, 0805	2	C30
			C31
93091U	CAPACITOR 1uF, TANT	1	C9
9326100U	CAPACITOR 100uF 10V+-20% TANTA	1	C4
93261U	CAPACITOR Y5V 1206 1uF 50V	2	C1
			C59
93ADEBXX47N	CAPACITOR 47nF, 0603	1	C66
93ADHBXX10N	CAPACITOR 10nF XR7	4	C5
			C10
			C33
			C36
93ADHBXX1N	CAPACITOR 1nF 0603	3	C34
			C54
			C64
93AFFDXX100N	CAPACITOR 100nF, 0603	5	C3
			C13
			C35
			C55
			C60

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Part No.	Description	Qty	Reference
93BDHXXX2N2	CAP. 2n2, 0805 X7R	1	C6
93IDDCXX22U	CAP. 22uF TANT. ELECT	2	C58
			C65
93HDECXX22U	CAP. 22uF TANT. ELECT	1	C76
940024022	RESET CONTROLLER S24O22 +2KMEM	1	IC3
94007225GB	LCD DRIVER UPD7225GB-3B7 QFP	1	IC7
940074HC74	DUAL D-TYPE FLIP FLOP	1	IC2
940078F0034GK	FLASH MICRO UPD78FOO34AGK-8A8	1	IC6
9400LM339	QUAD OP AMP	1	IC4
9400LM78L05	VOLT REGULATOR LM78L05ACM	1	IC1
95002N7002	2N7002 MOSFET	2	TR14
			TR21
9500BC817	BC817	1	TR20
9500BC849C	BC 849C	1	TR12
9500IMT1	DUAL TRANSISTOR ARRAY	1	TR5
9500IMX1	DIGITAL TRANSISTOR ARRAY	6	TR2
			TR3
			TR6
			TR7
			TR15
			TR19
9500IMZ1	DUAL TRANSISTOR ARRAY	1	TR1
9501BC868	BC868	1	TR18
96004MHZ	CRYSTAL 4.0MHz, HC49/4HSMX	1	XT1
9600L1	CHIP INDUCTOR	5	L3
			L6
			L8
			L13
			L15
9600L13	INDUCTOR, 3.3uH +/-20%	1	L12
9600L3	CHIP INDUCTOR, 10uH +/-20%	3	L1
			L2
			L22

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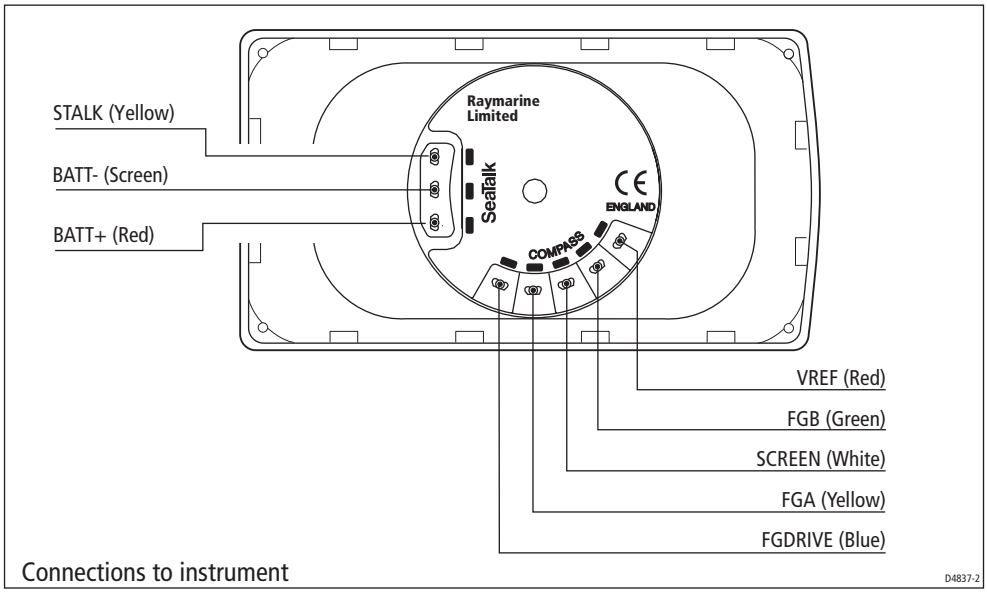
Chapter 5: ST40 Compass Instrument

Input/output signals



Connections to instrument

Signal	Description
STALK	Intermittent streams of (nominal) 12 V pulses
BATT-	0 V
BATT+	Nominal 12 V dc supply
VREF	Fluxgate 2.5 V
FGB	Sense B
SCREEN	Fluxgate 0 V return
FGA	Sense A
FGDRIVE	Fluxgate drive

Refer also to the *ST40 Compass circuit diagram*.

Self-test procedure

Each ST40 instrument has built-in self-test functions to aid fault diagnosis.

To self-test an ST40 Compass instrument:

- Press the ▲ and ⊙ keys simultaneously for 4 seconds, to access self-test mode, then within 2 seconds, press the ▲ and ▼ keys together momentarily, to start self-test stage 1.

Self test stage 1

When entering self test stage 1, the instrument beeps and the display shows TEST 1, for 1 second. The following tests are then performed automatically:

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- SeaTalk self test, which checks the receive and transmit circuits.
- EEPROM test (read and write).

If the tests are satisfactory, PASS is shown on the display.

If the tests are not satisfactory, the following failure codes may be generated:

Message	Failure Mode	Action
FAIL 8	SeaTalk Rx/Tx	Check for damaged bucket connectors/rear-case pins. Check SeaTalk interface components around TR1, TR2 and TR3.
FAIL 18	EEPROM failure	Replace EEPROM (IC2)

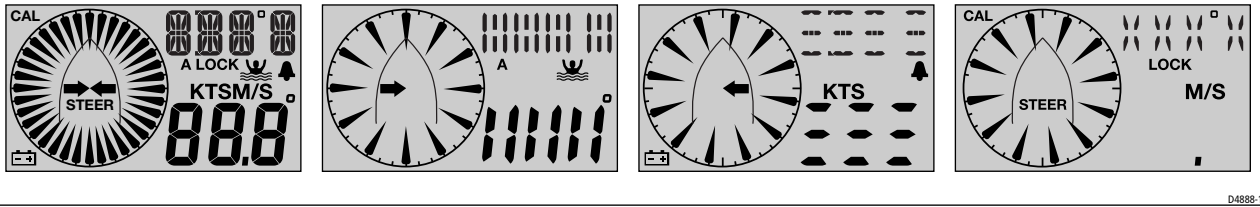
If there is no audible beep, check TR19(b) and RN3 and the buzzer for damage. If the beep volume is low, check R93.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 2.

Self-test stage 2

When entering self test stage 2, the instrument beeps and the display shows TEST 2, for 1 second. The following tests are then performed automatically:

- The display backlighting cycles between on and off every second.
- A display test is performed. The LCD segments are displayed in the following sequence, changing once per second:



While this test is progressing, press each of the front panel keys and check that the buzzer sounds as each key is pressed.

If any problems occur, use the following table as a guide to try to remedy the problem:

Failure	Action
No illumination	Check TR18 and associated components. Check all LEDs.
No beep when key pressed	Replace keyswitch.
LCD segment(s) missing completely	Check LCD pins for poor/dry joints. Check IC7 pins for poor/dry joints.
Faint LCD segments	Check LCD for short circuited pins. Check IC7 for short circuited pins. Check the contrast drive circuit around TR6.

Press the ▲ and ▼ keys together momentarily, to proceed to self-test stage 3.

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Self-test stage 3

Note: *A known good Fluxgate Compass transducer must be connected, for this test.*

When entering self test stage 3, the instrument beeps and the display shows TEST3, for 1 second.

If the instrument detects valid compass readings in all four heading quadrants within 15 seconds of the start of test stage 3 and if the compass transducer interface is satisfactory, PASS is shown on the display.

If the test fails, FAIL29 is displayed. Use the following table to try to isolate the cause.

Check	Failure mode	Action
VREF voltage at P11	Not 2.5 V	Ensure L17 is not open circuit. Check VRESET is 2.5 V
SCREEN voltage at P9	Not 0 V	Ensure L10 is not open circuit
FGDRIVE repetitive pulse train at P7.	No pulses	Ensure L16 is not open circuit. Check that pulse train is present both sides of C39. Check drive circuit components around TR16 & TR17.

If you have not isolated the fault after using the above table:

- Ensure L18, L19 are not open circuit.
- Check ADC circuit components, i.e. IC8, IC9 and associated components.

Press the ▲ and ▼ keys together momentarily to exit self-test.

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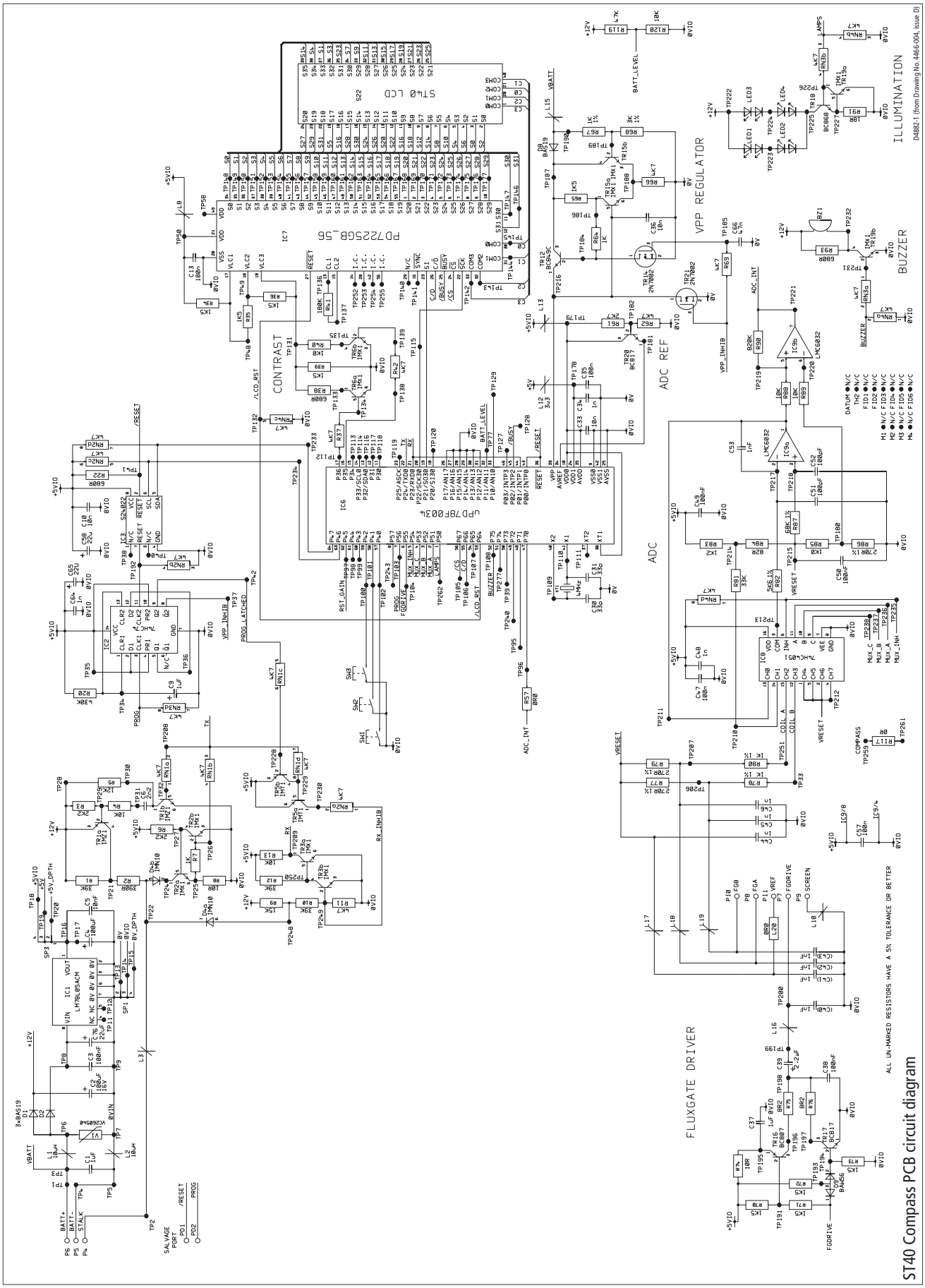
ST40 Compass PCB assembly



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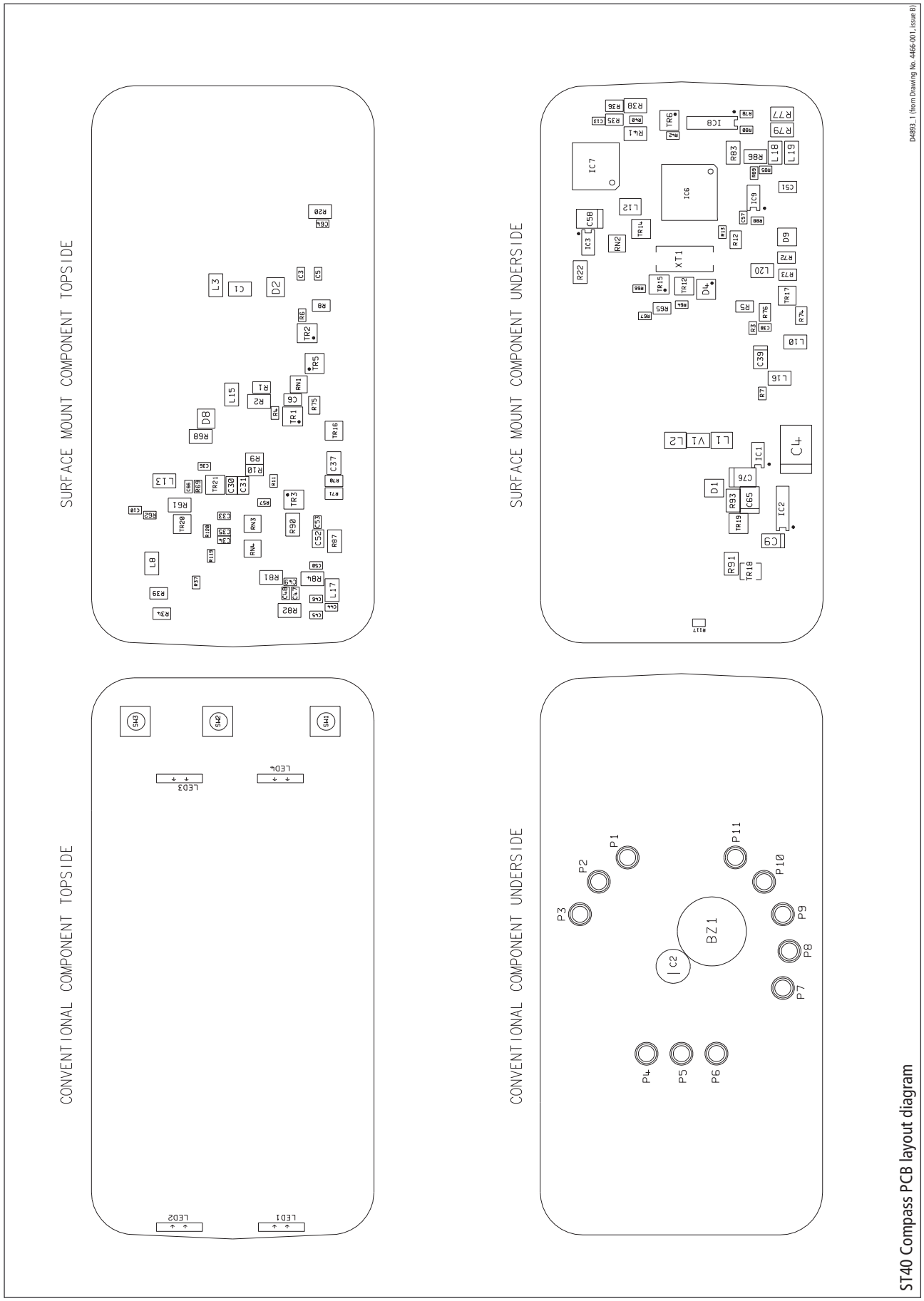

ST40 Compass PCB layout diagram

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ST40 Compass PCB assembly component list

Part No.	Description	Qty	Reference
03065	CAP 100uF 16V	1	C2
06030	ALPS TACT. SWITCH (RED)	3	SW1
			SW2
			SW3
15136	BUZZER EFM-250D	1	BZ1
15165	LED LTIF24-A2 GREEN	4	LED1
			LED2
			LED3
			LED4
4466-001SM	ST40 COMPASS SM PCB ASSY	1	
3015-201-E	ST40 DIGITAL PCB	1	
91010R0	ZERO OHM LINK, 0603 PACKAGE	2	R57
			R117
910210R	RESISTOR 10 OHM 0805	2	R8
			R74
910212K	RESISTOR 12K+-5% 0805 0.1W	1	R5
910215K	RESISTOR 15K+-5% 0805 0.1W	1	R9
91021K5	RESISTOR 1K5+-5% 0805 0.1W	9	R34
			R35
			R36
			R39
			R70
			R71
			R72
			R73
			R65
910239K	RESISTOR 39K+-5% 0805 0.1W	3	R1
			R10
			R12
91028R2	RESISTOR 8R2+-5% 0805 0.1W	2	R75
			R76
9103270R	RESISTOR 270R 1206	3	R77
			R79
			R86
910333K	RESISTOR 33K, 1206	1	R81
91033K	RESISTOR 3K0 1% 1206 1/8W	1	R68
9103430K	RESISTOR 430K, 1206	1	R20
91035K6	RESISTOR 5K6, 1206	1	R82
910368K	RESISTOR 68K, 1206	1	R87
910382R	RESISTOR 82R, 1206	1	R84
91060R0	RESISTOR 0R0, 1206	1	L20

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Part No.	Description	Qty	Reference
9106180K	RESISTOR 180K, 1206	1	R41
910618R	RESISTOR 18 OHM +/-5% - 1206	1	R91
91061K2	RESISTOR 1K2, 1206	1	R83
91062K7	RESISTOR 2K7 OHM, 1206	1	R61
9106390R	RESISTOR 390R, 1206	1	R2
9106680R	RESISTOR 680R, 1206	3	R22
			R38
			R93
9106820K	RESISTOR 820K, 1206	1	R90
9108VC260540	TRANSGUARD	1	V1
91124K7	RESISTOR NETWORK	4	RN1
			RN2
			RN3
			RN4
91AAAXXX10K	RESISTOR 10K,1% 0.063W 0603	5	R4
			R13
			R88
			R89
			R120
91AAAXXX1K0	RESISTOR 1.0K,1% 0.063W 0603	7	R7
			R40
			R64
			R67
			R78
			R80
			R85
91AAAXXX2K2	RESISTOR 2.2K,1% 0.063W 0603	2	R3
			R6
91AAAXXX47K	RESISTOR 47K,1% 0.063W 0603	1	R119
91AAAXXX4K7	RESISTOR 4.7K,1% 0.063W 0603	6	R11
			R37
			R42
			R62
			R66
			R69
9200BAS19	DIODE SOT23 BAS19	3	D1
			D2
			D8
9200BAW56	BAW56 DIODE	1	D9
9206IMN10	TRIPLE DIODE ARRAY - ISOLATE	1	D4
930133P	CAPACITOR 33pF, 0805	2	C30
930133P	CAPACITOR 33pF, 0805	2	C31
9302100P	CAPACITOR 100pF, 0805	2	C51
			C52

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Part No.	Description	Qty	Reference
93091U	CAPACITOR 1uF, TANT	1	C9
93102U2	CAPACITOR 2.2uF	1	C39
9326100U	CAPACITOR 100uF 10V+-20% TAN	1	C4
93261U	CAPACITOR Y5V 1206 1uF 50V	2	C1
			C37
93ADEBXX47N	CAPACITOR 47nF, 0603	1	C66
93ADHBXX10N	CAPACITOR 10nF XR7	4	C5
			C10
			C33
			C36
93ADHBXX1N	CAPACITOR 1nF 0603	7	C34
			C44
			C45
			C46
			C48
			C53
			C64
93AFFDXX100N	CAPACITOR 100nF, 0603	8	C3
			C13
			C35
			C57
			C47
			C49
			C38
			C50
93BDHXXX2N2	CAP. 2n2, 0805 X7R	1	C6
93IDDCXX22U	CAP. 22uF TANT. ELECT	2	C58
			C65
93HDECXX22U	CAP. 22uF TANT. ELECT	1	C76
940024022	RESET CONTROLLER S24O22 +2KM	1	IC3
94007225GB	LCD DRIVER UPD7225GB-3B7 QFP	1	IC7
940074HC4051	IC 74HC4051	1	IC8
940074HC74	DUAL D-TYPE FLIP FLOP	1	IC2
940078F0034GK	FLASH MICRO UPD78FOO34AGK-8A	1	IC6
9400LM78L05	VOLT REGULATOR LM78L05ACM	1	IC1
9400LMC6032	DUAL OP AMP	1	IC9
95002N7002	2N7002 MOSFET	2	TR14
			TR21
9500BC807	BC807	1	TR16
9500BC817	BC817	2	TR17
			TR20
9500BC849C	BC 849C	1	TR12
9500IMT1	DUAL TRANSISTOR ARRAY	1	TR5

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Part No.	Description	Qty	Reference
9500IMX1	DIGITAL TRANSISTOR ARRAY	5	TR2
			TR3
			TR6
			TR15
			TR19
9500IMZ1	DUAL TRANSISTOR ARRAY	1	TR1
9501BC868	BC868	1	TR18
96004MHZ	CRYSTAL 4.0MHz, HC49/4HSMX	1	XT1
9600L1	CHIP INDUCTOR	9	L3
			L8
			L10
			L13
			L15
			L16
			L17
			L18
			L19
9600L13	INDUCTOR, 3.3uH +/-20%	1	L12
9600L3	CHIP INDUCTOR, 10uH +/-20%	2	L1
			L2

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Part 3 Transducer Servicing

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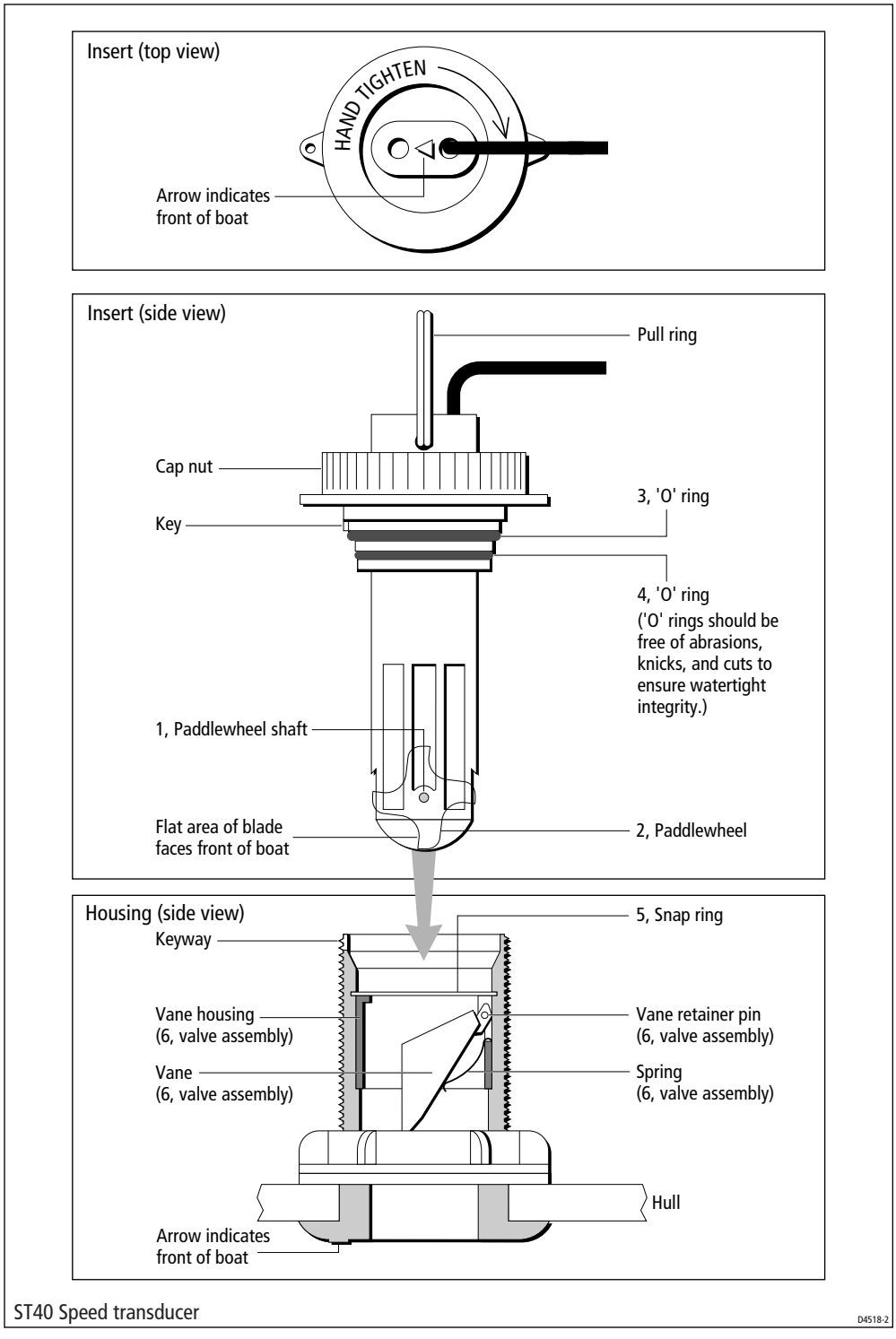
Chapter 1: ST40 Speed Transducer



ST40 Speed transducer

Changing a paddlewheel

To change a paddlewheel, refer to the *ST40 Speed transducer* illustration, and:

1. Use the new paddlewheel shaft from the spare parts kit to push out the old shaft (1) approximately 5 mm (1/4 inch).
2. Grasp the end of the old shaft (1) with pliers and pull it straight out, to release the paddlewheel (2).
3. Place the new paddlewheel (2) in the insert assembly cavity.

IMPORTANT: Ensure that the flat surface of the paddlewheel blades face the direction of the arrow on top of the insert assembly.

When the insert assembly is installed in the housing, the arrow on the top insert cap and the water exposed flat surface of the housing should both face the front of the vessel.

4. Tap the new shaft (1) into place until it is flush with the housing, ensuring that the shaft enters the centre hole of the paddlewheel bearing. Failure to align the bearing before inserting the shaft can result in bearing damage.

Changing the valve assembly

The transducer incorporates a self-sealing valve which minimizes the flow of water into the vessel if the insert assembly is removed. When the insert assembly is removed, the curved vane is activated by a spring and by water pressure, which push the vane upward to seal the opening. The valve assembly is held in place with a corrosion resistant snap ring.

WARNING:

Do NOT attempt to remove the self-sealing valve assembly when the vessel is in the water, as the consequent inflow of water may cause the vessel to sink.

If the valve mechanism fails, ensure the vessel is not in the water, refer to the *ST40 Speed transducer* illustration, and carry out the following:

1. Remove the snap ring (5), using a screwdriver to pry the end of the ring free.
2. Slide the valve assembly upward, out of the housing.

Note: *The vane retainer pin is a loose slip-fit and may slide out when the assembly is removed from the housing.*

3. To install a valve assembly, insert it into the housing (vane tongue pointing downward). Install the snap ring (5), making certain that it locks into its groove in the housing wall.

ST40 Speed transducer spare parts list

The **item** numbers refer to the *ST40 Speed transducer* illustration.

Item	Spare/Accessory Description	Part No.	Comments
	Speed transducer service kit	D234	
	comprising:		
1	Paddlewheel shaft		
2	Paddlewheel		
3	'O' ring (x2)		
4	'O' ring (x2)		
5	Snap ring		
6	Valve assembly		

Insert assembly installation

When reinstalling the insert assembly:

- Ensure that the 'O' rings have been inspected and if necessary, replaced and lubricated
- Ensure that the key of the insert assembly locates with the keyway of the housing assembly.
- Secure with cap nut (hand tighten).

ST40 Speed transducer connections

Cable core colour	Instrument head circuit diagram reference	Description
Red	12V	Approximately 11.2 V dc out
Green	SPD	With transducer attached, spinning paddlewheel produces pulses approximately 11.2 V dc in amplitude at 5.5 Hz/knot.
Screen	0V	0 V
White	TEMP	With transducer attached, voltage here is dependent on temperature. Approximately 1.8 V at 0 degrees C.
Brown	0VANA	0 V

Chapter 2. ST40 Fluxgate Compass Transducer

Functional test

Disconnect the Fluxgate Compass from the instrument and check continuity as follows:

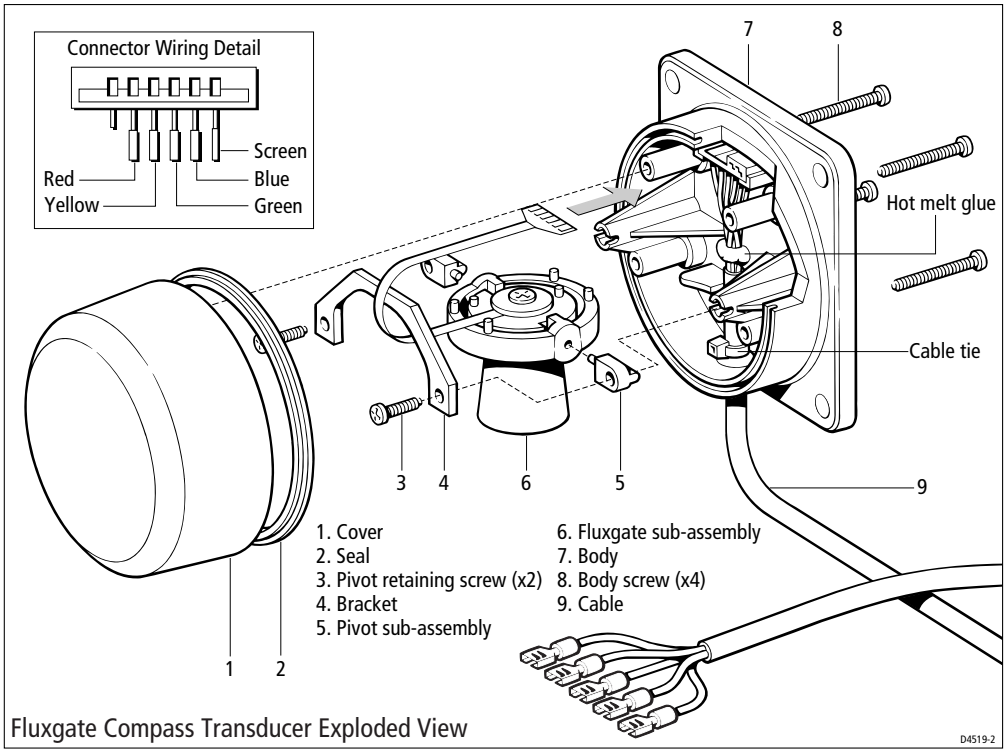
Cable colour	Resistance
Screen to blue	< 10 ohms
Red to green	< 5 ohms
Red to yellow	< 5 ohms
Red to screen	Open circuit

Magnetic deviation

The Fluxgate Compass requires careful siting to achieve optimum performance. The instrument software is able to correct the compass for most deviating magnetic fields present when the linearisation procedure is carried out. Any further deviation introduced after linearisation, will introduce an error between the Fluxgate Compass and the ship's compass. This can be removed by carrying out the linearisation again. If the displayed deviation is greater than +/– 15 degrees the Fluxgate should be resited. For installation and calibration information, refer to the *ST40 Compass Instrument Owner's Handbook*.

Note: *The linearisation procedure should always be carried out if the Fluxgate Compass has been exchanged, or moved from its original mounting position.*

Disassembly/reassembly



Fluxgate Compass Transducer Exploded View

Fluxgate Compass spare parts list

The **item** numbers refer to Figure 2: Fluxgate Compass exploded view

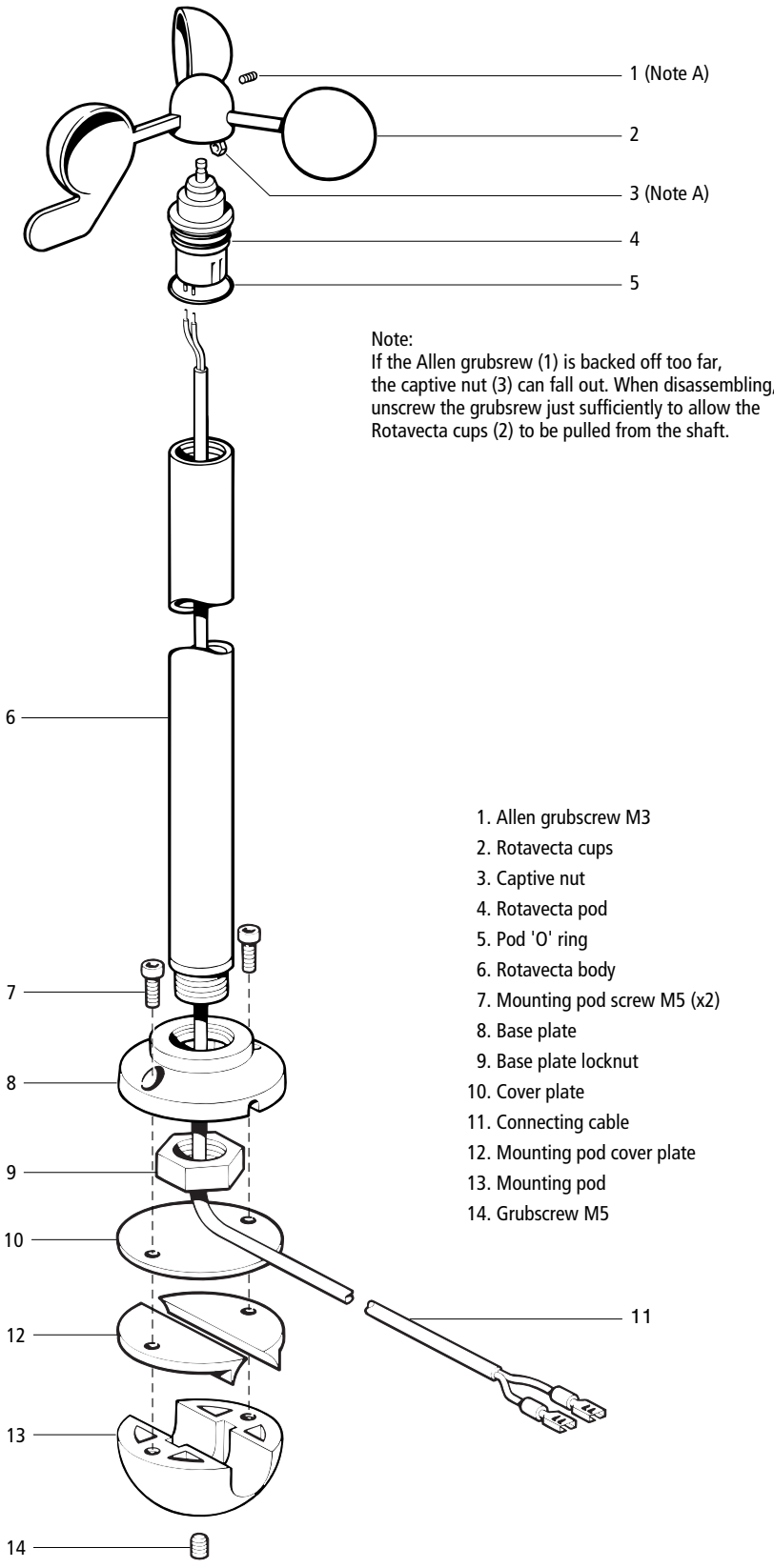
Item	Spare Description	Part No.	Comments
	Compass base kit *comprising:*	M096	
3	Pivot retaining screw (x2)		
4	Bracket		
	Fluxgate sub-assembly *comprising:*	M022	
5	Pivot sub-assembly (x2)		
6	Fluxgate sub-assembly		

ST40 Fluxgate Compass transducer connections

Cable core colour	Instrument head circuit diagram reference	Description
Red	VREF	Fluxgate 2.5 V
Yellow	FGA	Sense A
Green	FGB	Sense B
Blue	FGDRIVE	Fluxgate drive
White	SCREEN	Fluxgate 0 V return

Chapter 3. Rotavecta Wind Transducer

Disassembly/reassembly



Rotavecta Wind Transducer Exploded View

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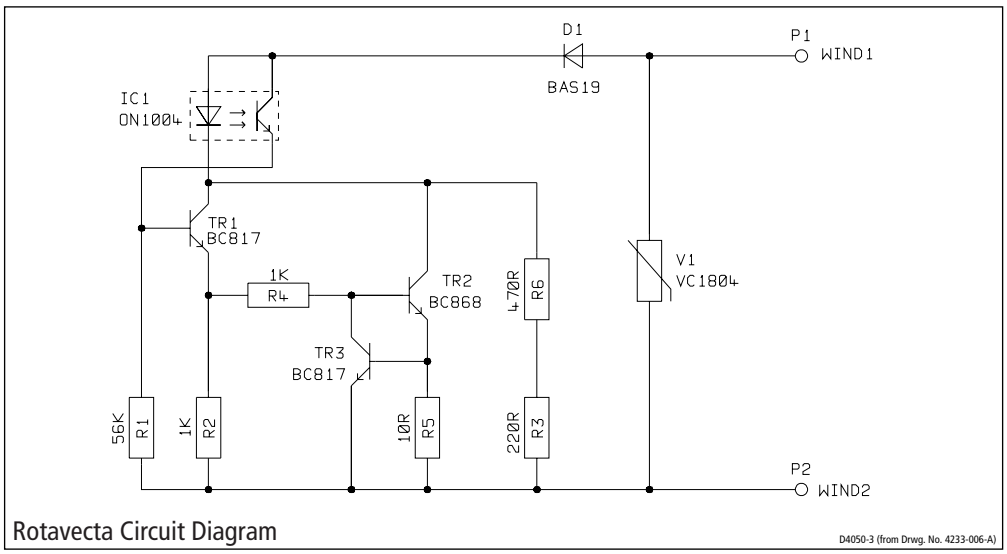
Rotavecta spare parts list

The item numbers are shown in the *Rotavecta Wind Transducer Exploded View*.

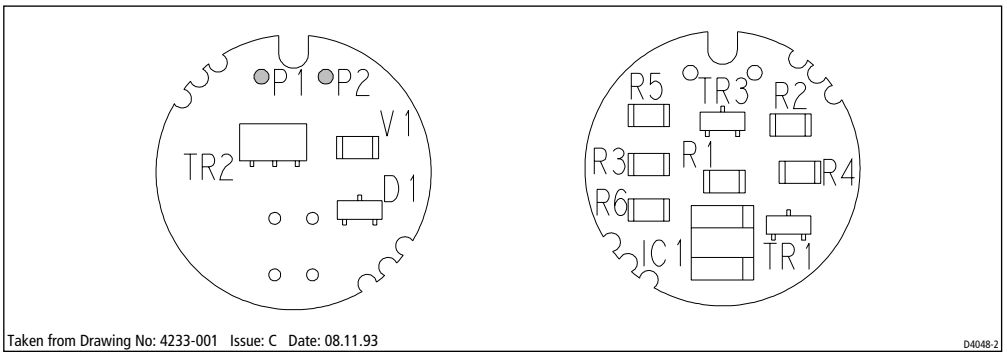
Item	Spare/Accessory Description	Part No.	Comments
	Rotavecta transducer kit *comprising:*	D240	
1	Allen grubscrew M3		
2	Rotavecta cups		
3	Captive nut M3		
	Rotavecta pod assembly *comprising:*	Q113	
4	Rotavecta pod		
5	Pod 'O' ring		
	Rail mounting kit *comprising:*	D316	
7	Mounting pod screw M5(x2)		
8	Base plate		
9	Base plate locknut		
10	Cover plate		
11	Connecting cable		
12	Mounting pod cover plate		
13	Mounting pod		
14	Grubscrew M5		

Rotavecta PCB details



Rotavecta Circuit Diagram

D4050-3 (from Drwg. No. 4233-006-A)



Taken from Drawing No: 4233-001 Issue: C Date: 08.11.93 D4048-2

PCB component list

9501BC868	BC868	TR2
9500BC817	BC817	TR1, TR3
9200BAS19	DIODE SOT23 BAS19	D1
9108VC180400	TRANSIENT VOLTAGE SUPRESSOR	V1
910656K	RESISTOR 1206 56K	R1
910647470R	RESISTOR 1206 470R	R6
9106220R	RESISTOR 1206 220R	R3
910310R	RESISTOR 1206 10R	R5
91031K	RESISTOR 1206 1K	R2, R4
24010	B* VERO SOLDER PIN 18-0223K	P1, P2
06027	OPTO SWITCH	IC1
3015-074	ST30 WIND TRANS PCB	

Taken from Drawing No: 4233-001 Issue: C Date: 08.11.93 D4049-2

Rotavecta connections

Cable core colour	Signal name at Rotavecta PCB	Signal name at Instrument PCB	Description
Red	WIND1	ROTA+	Constant current source
Blue	WIND2	ROTA–	0V