

**TILLERPILOT**  
**TP10, TP20 & TP30**  
**SERVICE MANUAL**

**SIMRAD**

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# **Tiller Pilot TP10, TP20 & TP30**

## **Section 1**

### **Introduction**

## **1 INTRODUCTION TO THE TP10, TP20 AND TP30 TILLERPILOT**

The TP10, TP20 and TP30 Tillerpilots combine highly sophisticated electronics with advanced software and powerful mechanical drive to provide accurate and reliable steering performance under a variety of different conditions with minimal current consumption.

**TP10** – is suitable for tiller steered sailing yachts up to 10M (34 Ft) in length.

**TP20** – offers the same facilities as the TP10 and is fully compatible with the Navico Corus instrument system to provide a complete navigation system. Options offered include connection to an external compass, wind sensor or navigational receiver together with additional remote control facilities.

**TP30** – offers the same facilities as the TP20 with an improved re-circulating ball screw drive and is suitable for tiller steered sailing yachts up to 12.8M (42 Ft) in length.

The main components of the Tiller Pilot are listed below:

### **Electronics PCBs**

#### **Early versions**

TP10 PCB (TP10 only)  
TP30 PCB (TP 20 & TP30)

**Current Versions.** The same PCB is used for all products. The wiring loom carrying the NMEA data is left disconnected in the TP10.

TP10 / 20 / 30 Re-engineered PCB (Common to all)

### **Mechanical Components**

General Assy : TP10  
General Assy : TP20  
General Assy : TP30

# **Tiller Pilot TP10, TP20 & TP30**

## **Section 2**

### **Operation**

## **2 OPERATING SIMRAD**

This Service Manual only contains operating instructions for those features of the Simrad Tiller Pilot range that are not normally available to the end user. For details of normal operation please refer to the appropriate Simrad Instruction Manual.

# **Tiller Pilot TP10, TP20 & TP30**

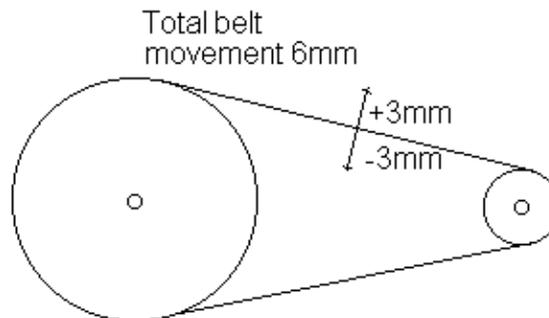
## **Section 3**

### **Assembly Instructions**

### 3 ASSEMBLY INSTRUCTIONS

#### General Assembly : TP10

**Motor and Drive Assembly.** The Bottom Case Assembly is supplied fitted with appropriate cables. Refer to detail in Drawing Number [E03504](#) and insert the Push Rod Seal E00747, which has a taper inner bore, into the case with the larger bore of the seal facing outwards. Fit "O" Ring 190026, spacer E02870 and End Cap E02495 and push home. Fit Retainer E03084 and secure with 2 screws 200002 to hold the end cap, ensuring it is pushed fully in when the two screws are tightened. Using a small brush, grease the 'trough' area and the bore which houses the seal, "O" ring and spacer. Insert the Drive Assembly E03264 ensuring that the bearing slots into the bearing housing and the drive belt 280027 is fitted around the pulley. Insert the Motor Assembly E02788 fitted with front and rear Motor Mounts E02502 and E02503 ensuring that the blue wire is uppermost, the motor sits snugly into the bottom of the retaining slot and the drive belt is engaged over the motor drive pulley. Check that the motor, belt and drive screw assembly move freely. Fit Bearing Clamp E02497 on two Nylon Spacers 200115, one on each screw 200137, into the case bottom and secure the bearing with the two screws. Refer to the sketch below and check that the belt tension is within +/- 3mm.



Fit the Tiller Connector E02607 into the end of the Push Rod E02522 and screw in, finger tight.

**Hall Effect PCB.** Fit the Hall effect PCB onto the 2 pillars using 2 nylon washers 200037 as spacers between the pillars and the PCB, and 2 screws 200139. Ensure that the separation distance between the Magnets (E03208), seated in the 71 Tooth Pulley (E02505), and the Hall Effect Devices (140010) does not exceed 1mm.

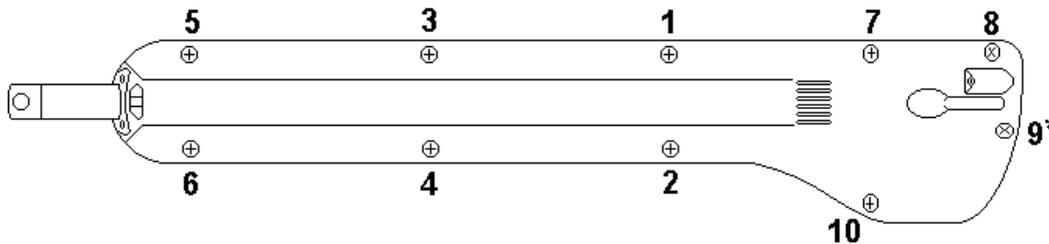
**Main PCB.** Feed the power, motor and feedback leads through the 2 grommets 190036 and the appropriate grommet in the PCB Assembly cover and solder the connections to the PCB. Refer to drawing and push PCB Assembly firmly onto the four bosses in the PCB Cover E02680. Clip the compass Assembly E02637 into the Drilled PCB Cover E02680, it can only be fitted one way round, ensuring that the lugs on the compass assembly line up with the 2 holes in the PCB cover and push in. Refer to drawing [E03504](#) and ensuring that the wires from the compass to the connector lay over the PCB, insert plug into the socket on the PCB. Ensure all wires are clear of, and not fouling the PCB cover seal, and position the PCB Cover complete with the PCB and compass into the Case Top Assembly E02612. Screw down the PCB cover with 6 screws 200139 and fully tighten. Position the two grommets into case top, and push home into the two slots. Wrap the 'Wits' fixing 200196 around the cable loom, and using a screw 200139 fix into the top cover.

**Main Seal.** Fit the pivot pin into the square section at the rear of the prepared bottom case ensuring that the pin hangs out of the case with the notch on the pivot facing towards the operating rod of the tillerpivot. Fold the metal pin into its recess in the lower case. Position the Case Seal E02498 onto the case bottom ensuring it is pushed fully into the grooved housing. Carefully lift the case seal from around the area of the pivot pin and using a cotton bud apply Dow Corning 1205 Primer 260029 to the case. Fill a small hypodermic syringe with Dow Corning 3140 Silicone sealant 260001 and run a small bead of sealant completely around the case seal in the area of the square as shown below.



Refit the seal onto the case.

**Final Assembly.** Carefully position the case top onto the bottom ensuring that the case seal is correctly located all round, squeeze the top and bottom halves of the case together, and fit the 10 screws 200088. Tighten down evenly all round in the sequence shown below:



Tighten case screws in sequence 1 to 10

**\* Note** At screw No.9, stop and check lip on top case is correctly located into bottom case, before fully tightening up.

**Post Assembly Test.** Remove the Tiller Connector E02607 and push the Tillerpivot Test Syringe Part No. TP-SRY over the end of the Push Rod E02522. Depress the syringe piston and release, the piston should return to its original position indicating that the integrity of the case seal has not been compromised during fitting. Remove the Test Syringe and refit the Tiller Connector.

**General Assembly : TP20**

Refer to Drawing No. [E03505](#). Assembly is identical to the TP10 with the following exceptions:

**Case Bottom.** The case bottom includes a third wiring (communications) loom to carry NMEA and CANBUS data.

**PCB Cover E02681.** The PCB Cover is drilled with a third access point and grommet to accept the NMEA and CANBUS data leads.

## **General Assembly : TP30**

Refer to Drawing No. [E03506](#). Assembly is identical to the TP20 with the following exception:

**Drive Assembly E02618.** The Drive Assembly employs a re-circulating ball screw. The assembly is held in place by the metal mounting plate sitting in the mounting slots in both top and bottom cases and drive belt tension is adjusted by the inclusion of spacing shims E02754 as required.

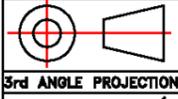
**Tiller Pilot TP10, TP20 & TP30**

**Section 4**

**Mechanical Assembly Drawings**

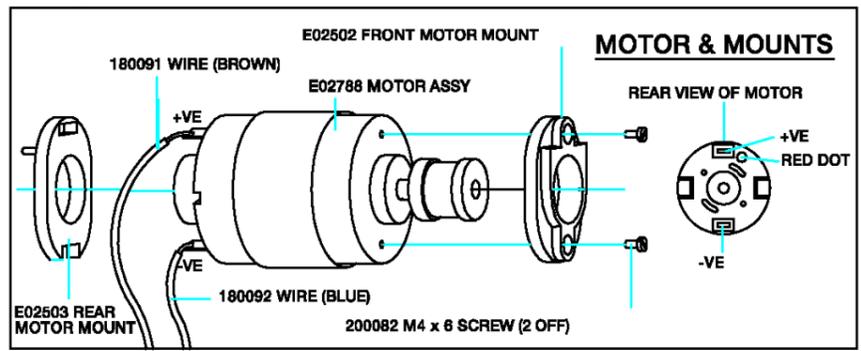
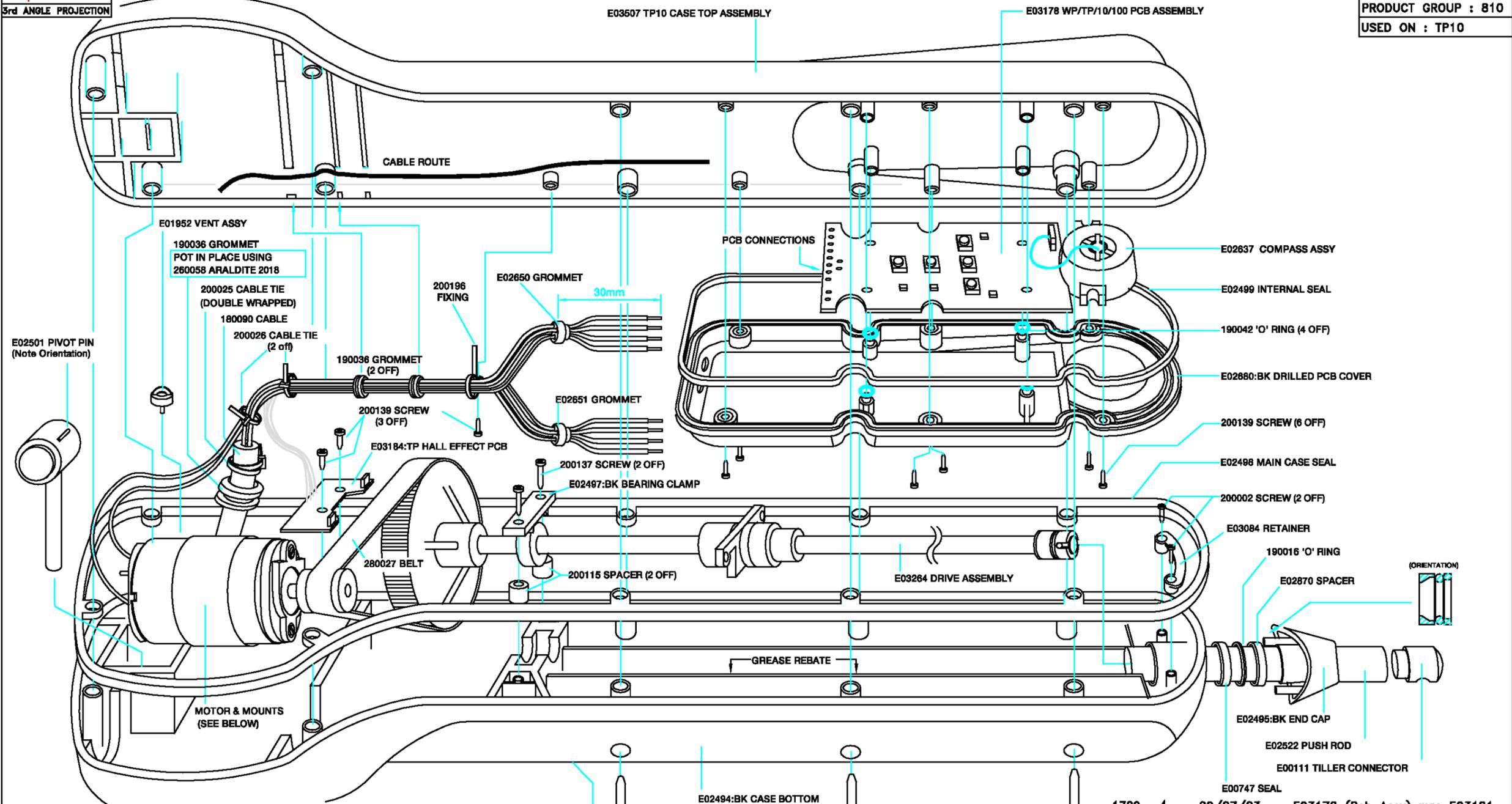
## 4 MECHANICAL ASSEMBLY DRAWINGS

General Assembly : TP10	E03504
General Assembly : TP20	E03505
General Assembly : TP30	E03506



DRAWN IN ACCORDANCE WITH BS 308

DRG No.:  
**E03504**  
PRODUCT GROUP : 810  
USED ON : TP10



**DO NOT SCALE IF IN DOUBT ASK**

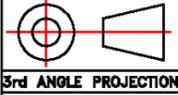
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+44 1843 290290

1729	4	09/07/03	E03178 (Pcb Assy) was E03181
1375	3	14/9/99	E03184:TP WAS E03184
1312	2	3/3/99	200281 (10 OFF) WERE 200088

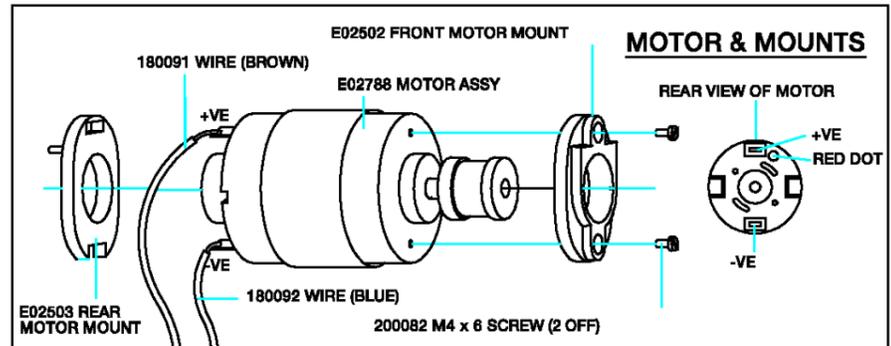
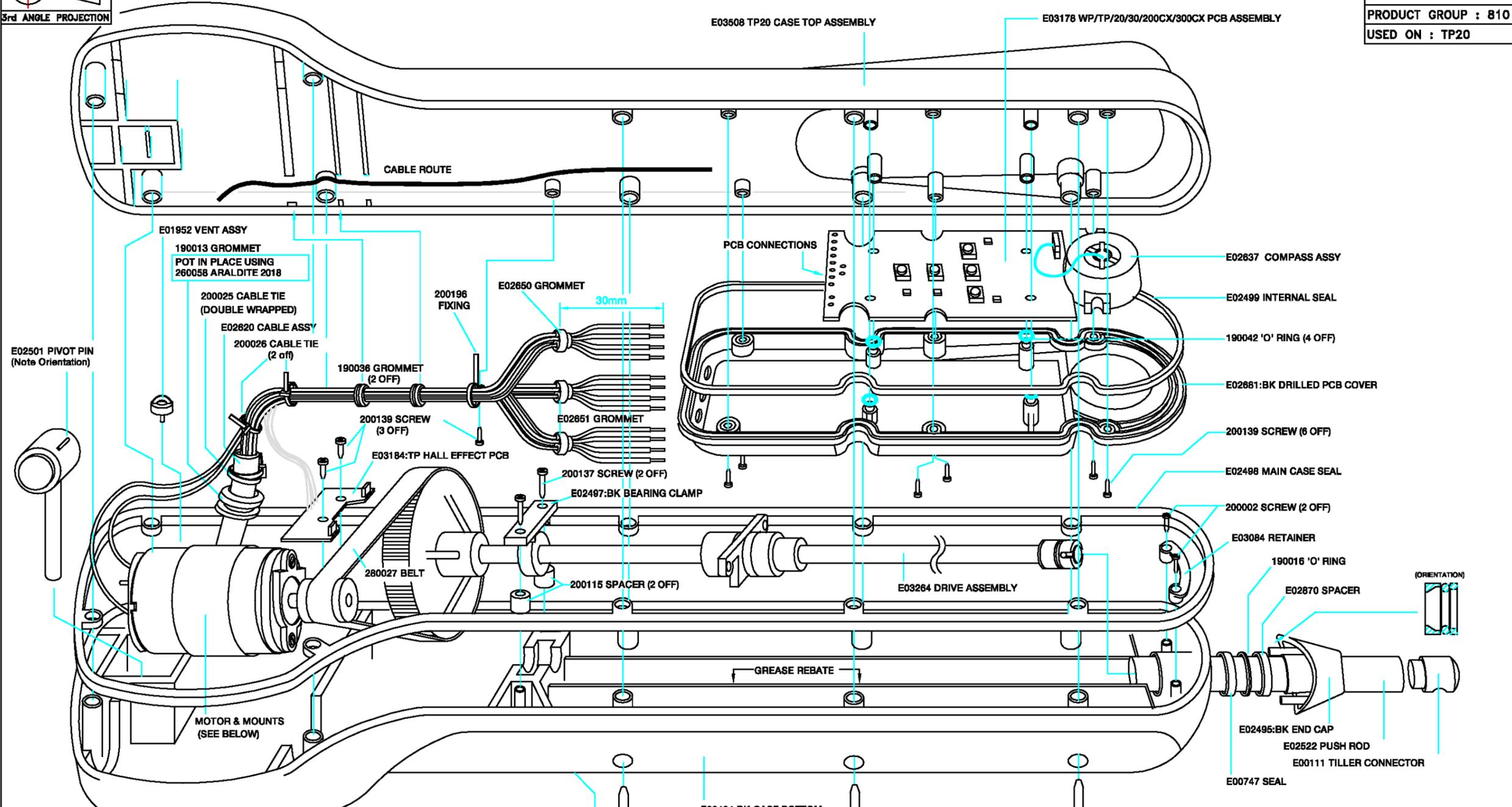
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Finish:	<b>TP10</b>		0.0 = 0.25
Date: 27/11/98	Original Scale:	<b>GENERAL ASSEMBLY</b>	0.00= 0.10
NTS		<b>DRG No.:</b> E03504	ANG. = 0.5°
		<b>Issue</b> 4	ALL DIMENSIONS mm

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SHT. 1 OF 1

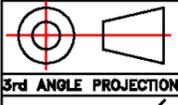


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DRG No.: **E03505**  
 PRODUCT GROUP : 810  
 USED ON : TP20



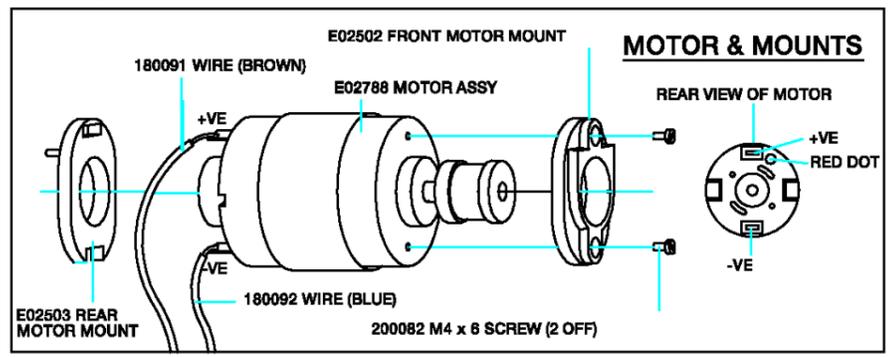
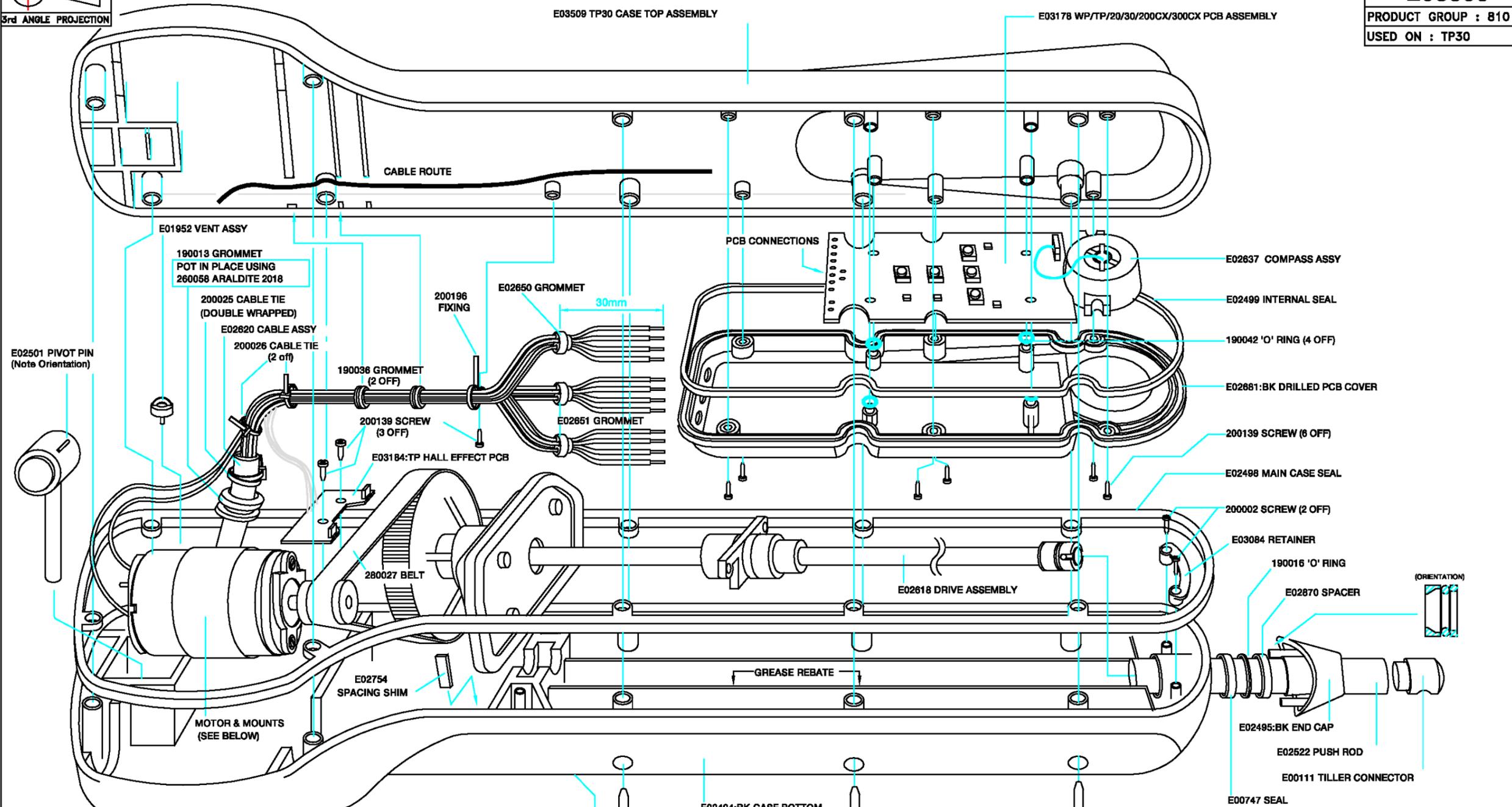
<b>DO NOT SCALE</b>		<b>IF IN DOUBT ASK</b>		1740 4 15/8/03	Updated with new PCB shape E03184:TP WAS E03184 200281 (10 OFF) WERE 200088			
				1375 3 14/9/99				
				1312 2 3/3/99				
				Mod.No.	Iss.	Date:	Modifications	
<b>SIMRAD</b> A KONGSBERG Company	STAR LANE, MARGATE, KENT CT9 4NP TEL: 01843 290280 FAX: 01843 290471 +44 1843 290280			Drawn: <b>BPL</b>	Checked:	Approved:	Tolerances + & -	ALL DIMENSIONS mm
				Date: 3/2/99	Date:	Date:	0. = 0.50	<b>SIMRAD</b> 2003
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			Date: 27/11/98	Original Scale: <b>NTS</b>				



DRAWN IN ACCORDANCE WITH BS 308

E03509 TP30 CASE TOP ASSEMBLY

DRG No.: **E03506**  
 PRODUCT GROUP : 810  
 USED ON : TP30



DO NOT SCALE		IF IN DOUBT ASK		1740	4	15/8/03	Updated with New PCB shape
				1375	3	14/9/99	E03184: TP WAS E03184
				1312	2	3/3/99	200281 (10 OFF) WERE 200088
				Mod.No. Iss. Date:		Modifications	
<b>SIMRAD</b> A KONGSBERG Company	STAR LANE, MARGATE, KENT CT9 4NP TEL: 01843 290290 FAX: 01843 290471 +44 1843 290290		Drawn: <b>BPL</b>	Checked:	Approved:	Tolerances + & - 0. = 0.50 0.0 = 0.25 0.00 = 0.10 ANG. = 0.5°	
			Date: 15/8/03	Date:	Date:	ALL DIMENSIONS mm	
			COMPUTER GENERATED DRAWING MANUAL MODIFICATION INVALIDATES CAD FILE.			© <b>SIMRAD</b> 2003	
			Model: <b>TP30</b>			SHT. 1 OF 1	
		Title: <b>GENERAL ASSEMBLY</b>			Drg No.: <b>E03506</b>		Issue <b>4</b>
		Date: 27/11/98	Original Scale: NTS				

# **Tiller Pilot TP10, TP20 & TP30**

## **Section 5**

### **Circuit Descriptions**

## 5 CIRCUIT DESCRIPTIONS

### Tillerpilot Common PCB Assembly

**Introduction.** The PCB Assembly is a common item to all Wheelpilots and Tillerpilots. However, when the PCB is used in the TP10 or WP10 those components concerned with NMEA and CANBUS data are present but not in use, these components are highlighted in Red on the Circuit Diagram Drawing No. [E03372](#).

**Supply and Regulation.** The Tiller Pilots are designed to work from a 12 V source. Protection against incorrect polarity is provided by D1 and D4. Capacitors C1 and C3 are used as reservoirs to hold up the supply voltage and reduce any supply dips. Protection against over-voltage spikes is provided by Resistor R2 and Zener Diode ZD1 and Regulator REG1 provides a 5V regulated supply. Transient Voltage Suppressor TVS1 protects the MOSFET drive transistors, TR10 to TR13, from voltage spikes greater than +16V.

**Microprocessor.** Light Emitting Diodes LED1 to LED4 are driven from the microprocessor IC2 Ports P0.0 and P0.2 to P0.4 and turn OFF when the line goes HIGH via the transistor switches TR2 to TR5. When the transistors are off, resistors R32, R34, R36 and R38 provide a low current path for the LEDs to provide low level night illumination. The Audio Resonator AR1 is self resonating and switches ON when Port P0.5 goes HIGH via the transistor switch TR1 and resistors R59 and R60. The control key lines on Ports P4.0 to P4.4, normally pulled to +5V via resistors R7 to R11, are “scanned” by the microprocessor to detect if any of the switches have been operated and pulled the line LOW.

**NMEA Data In.** NMEA data is optically isolated by IC5 and then fed into Port P2.4 of the microprocessor. Transistors TR6, TR7 and TR8 and components D6, D7, D8, R17, R18 and R19 form a switch, protected from high voltages, driven from Port P0.1 of the microprocessor. The switch is used to apply the synchronisation pulse (HR200\_SYNC) to the NMEA line for products employing a Hand (Remote) Controller.

**CANBUS Data.** CANBUS data in and out is driven by IC3 directly to and from Ports P2.1 and P2.0 respectively.

NB. Components shown in **RED** on the circuit diagram, Drawing No. E03372, are not in circuit when the PCB is used with WP10 or TP10. The cable loom to connect them is absent from these products.

**Configuration Links.** The Links, L1, L2 and L3, are used to configure the Microprocessor to either Wheelpilot or Tillerpilot operation and to model versions 10, 20 or 30 in accordance with the table below:

1	Model	Link 1	Link 2	Link 3
	TP 10	N / C	N / C	N / C
	WP 10	N / O	N / C	N / C
	TP 20	N / C	N / C	N / O
	TP 30	N / C	N / O	N / O
	WP 30	N / O	N / O	N / O

LEGEND    N / C    Normally Closed (soldered)  
               N / O    Normally Open (unsoldered)

**Microprocessor Reset.** Integrated Circuit IC6 is an integrated reset generator for the microprocessor which produces a reset LOW pulse of approximately 50mS duration at switch on and whenever a 5v supply failure occurs. In addition to the reset provided by IC6, the microprocessor has a built in watchdog timer which will create a reset if a software crash occurs for any reason.

**Non-Volatile Memory (NVM).** Integrated Circuit IC3 provides 1Kbit of E<sup>2</sup> memory for the retention of important data after power down.

**Fluxgate (Compass).** Two anti-phase signals are provided from microprocessor Ports P1.7 and P1.6. These signals are buffered by TR15 and TR16 to provide a higher current drive to the excitation coil of the fluxgate. A reference voltage level of +2 volts is provided by R46 and R53 decoupled by C53. The 2 coils, mounted at right angles, provide output signals proportional to the sine and cosine of the Earth's magnetic field. These signals are fed via the electronic switch IC9, to 2 dual slope integrating analogue to digital converters IC7 and IC 8 plus associated components. The outputs of the comparator IC7 are fed to the microprocessor Ports P1.4 and P1.5 which provide input capture facilities. Accurate timing of the conversion is kept by the microprocessor to provide simultaneous precision analogue to digital conversion of both sine and cosine signals to avoid errors created by multiplexing the inputs.

**Motor Drive.** The motor drive signals (MDRIVE\_A and MDRIVE\_B) are generated from the microprocessor at Ports P0.7 and P0.6, these lines being LOW when there is no drive and HIGH to drive. The drive outputs control IC10 and IC11 which are comparators set at threshold levels of +4V and +1V produced by the resistor network R71, R72 and R73. The comparators invert the signals and provide the current to switch the MOSFETs in stages which prevents both P and N channel MOSFETs on the same side of the "H-bridge" configuration, (i.e. TR10 and TR11 or TR12 and TR13), being partially switched on at the same time. When there is no drive, both N-channel MOSFETs TR11 and TR13 are switched on giving a direct short across the motor to the 0V line thus providing active braking

**EMC.** Capacitors with values of 100pF, 100nF and 1nF are extensively used to decouple noise from switched data lines. Two A.C. coupled connections labelled "CHASSIS" , routed via capacitors C63 and C64, were provided for interconnection to the internal metalwork for EMC purposes. Tests have confirmed that connection is not required.

### **Hall Effect PCB.**

**Introduction.** The Hall Effect PCB is a generic item which can be used for both Tillerpilots TP10, TP20 and TP30 and Wheelpilots WP10 and WP30. For Tillerpilots, the Hall Effect devices are mounted vertically into the PCB and horizontally for Wheelpilots. The circuit diagram for the Hall Effect PCB is given in Drawing No. [E03182](#).

**Feedback.** Two Hall Effect sensors HE1 and HE2 are mounted on the Hall Effect PCB and sense the rotation of 2 small bar magnets mounted 180<sup>o</sup> apart in the pulley wheel. This produces a quadrature feedback output, at logic levels, FB1 and FB2. The PCB is powered from the host unit +5V regulated supply, the line being filtered by C1, and signals FB1 and FB2 are fed back to the microprocessor via pull-up resistors on the host unit PCB.

# **Tiller Pilot TP10, TP20 & TP30**

## **Section 6**

### **Circuit Diagrams**

## 6 CIRCUIT DIAGRAMS

### Circuit Schematics

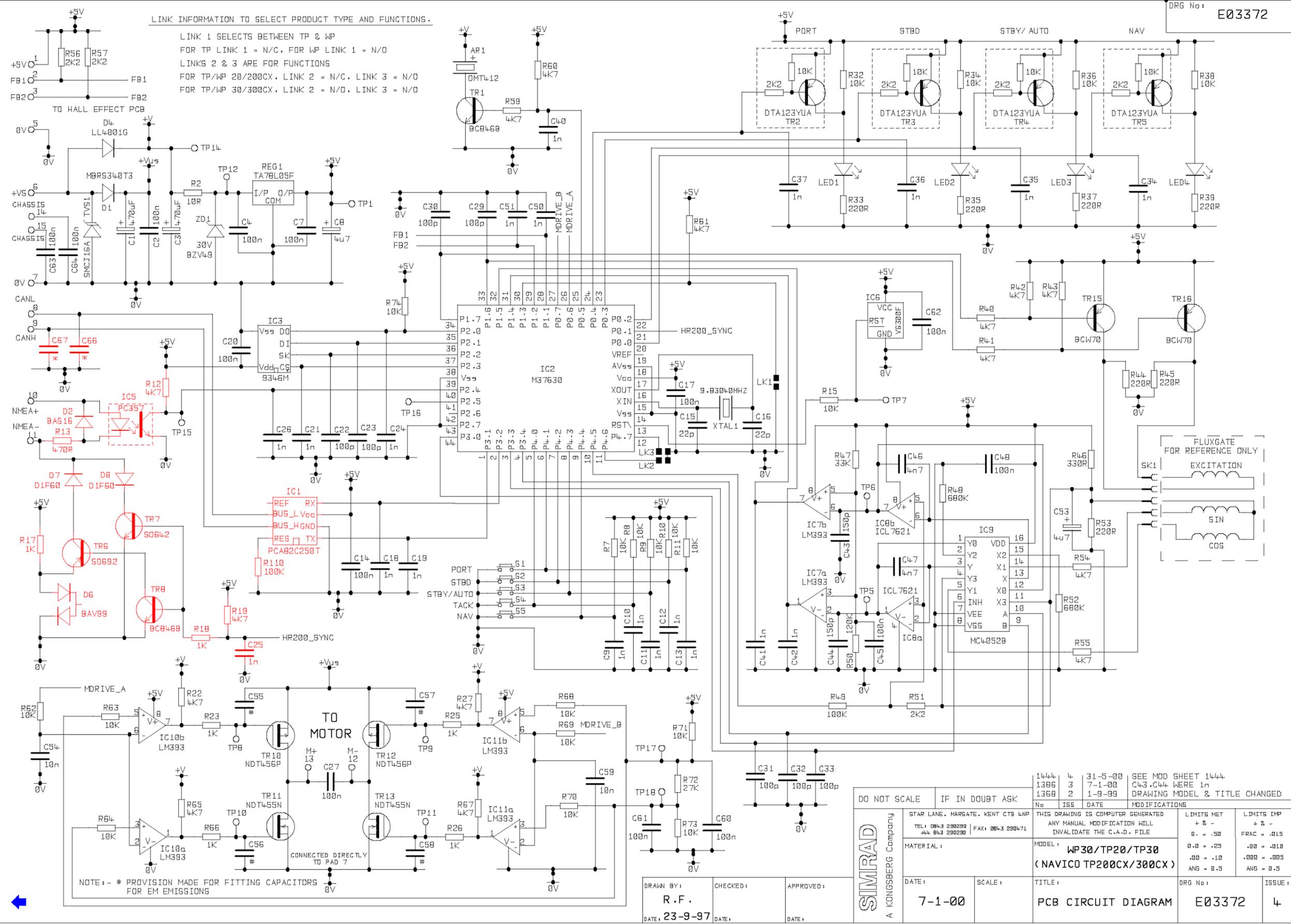
Common PCB Circuit Diagram	<a href="#">E03372</a>
Hall Effect PCB Circuit Diagram	<a href="#">E03182</a>

### Component Lists and Layouts

Common PCB Assembly Detail	<a href="#">E03178</a>
Hall Effect PCB Assembly Detail	<a href="#">E03184</a>
Early Version WP10 / TP10 Assembly Detail	<a href="#">E03181</a>
Early Version WP30 / TP20/30 Assembly Detail	<a href="#">E03178 (Pre Iss. 6)</a>

LINK INFORMATION TO SELECT PRODUCT TYPE AND FUNCTIONS.

LINK 1 SELECTS BETWEEN TP & WP  
 FOR TP LINK 1 = N/C, FOR WP LINK 1 = N/O  
 LINKS 2 & 3 ARE FOR FUNCTIONS  
 FOR TP/WP 20/200CX, LINK 2 = N/C, LINK 3 = N/O  
 FOR TP/WP 30/300CX, LINK 2 = N/O, LINK 3 = N/O



NOTE: - # PROVISION MADE FOR FITTING CAPACITORS FOR EM EMISSIONS

DO NOT SCALE		IF IN DOUBT ASK	
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MATERIAL:		MODEL:	
		WP30/TP20/TP30 (NAVICO TP200CX/300CX)	
DATE:	SCALE:	TITLE:	DRG No:
7-1-00		PCB CIRCUIT DIAGRAM	E03372
ISSUE:	DATE:	ISSUE:	DATE:
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DRAWN BY: R.F.  
 DATE: 23-9-97  
 CHECKED: DATE:  
 APPROVED: DATE:

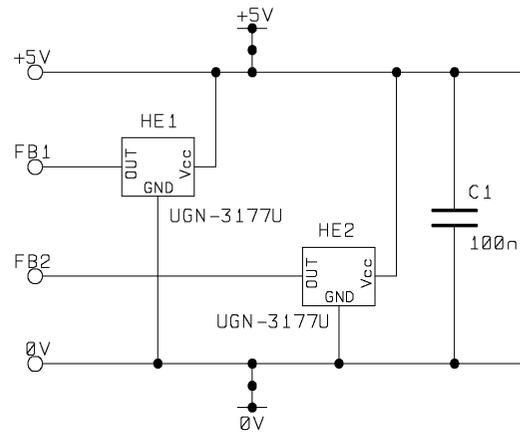
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1444 4 31-5-00 SEE MOD SHEET 1444  
 1396 3 7-1-00 C43,C44 WERE 1n  
 1368 2 1-9-99 DRAWING MODEL & TITLE CHANGED

No	ISS	DATE	MODIFICATIONS	LIMITS MET	LIMITS IMP
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.00 = .10				.000 = .005	
ANG = 0.5				ANG = 0.5	

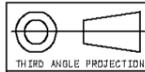
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MATERIAL:		MODEL: WP/TP10/30				
		(< NAVICO WP/TP300/100 >)				
DATE: 1-9-99	SCALE: 1	TITLE: HALL EFFECT PCB CIRCUIT DIAGRAM			DRG No: E03182	
					ISSUE: 2	

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DRG No: **E03178**

**SURFACE MOUNT COMPONENTS**

ITEM	QTY	PART No	COMP REF	DESCRIPTION
1	1	E03370	-	PCB DRILLED
2	6	100163	R33,R35,R37,R39,R44,R45	0805 220R
3	1	100175	R13	0805 4.70R
4	1	100181	R2	0805 10R
5	1	100330	R53	0603 220R
6	1	100332	R46	0603 330R
7	6	100338	R17,R18,R23,R25,R26,R66	0603 1K
8	3	100342	R51,R56,R57	0603 2K2
9	15	100346	R12,R19,R22,R27,R40,R41,R42,R43	0603 4K7
10	15	100350	R54,R55,R59,R60,R61,R65,R67	0603 10K
11	1	100355	R72	0603 27K
12	1	100356	R47	0603 33K
13	2	100362	R49,R110	0603 100K
14	1	100363	R50	0603 120K
15	2	100372	R48,R52	0603 680K
16	1	100377	R32	0603 20K
17	3	100404	R34,R36,R38	0603 50K
18	1	110104	C53	4u7 SM ELECT 16V
19	2	110245	C1,C3	470UF SM ELECT 25V
20	1	110169	C8	4u7 SM ELECT 25V
21	20	110194	C9,C10,C11,C12,C13,C18,C19,C21	0603 1n
			C24,C25,C26,C34,C35,C36,C37,C40	
			C41,C42,C50,C51	
22	2	110195	C46,C47	0603 4n7
23	1	110196	C54,C59	0603 10n
24	14	110199	C2,C4,C7,C14,C17,C20,C27,C45,C48	0603 100n
			C60,C61,C62,C63,C64	
25	2	110215	C15,C16	0603 22p
26	7	110223	C22,C23,C29,C30,C31,C32,C33	0603 100p
27	2	110225	C43,C44	0603 150p
28	3	120095	LED1,LED3,LED4	KM25205
29	1	120096	LED2	KM2520M
30	1	120036	D2	BAS16T
31	1	120038	ZD1	BZV49 30V
32	1	120040	D4	LL40016
33	1	120043	D6	BAV99
34	2	120070	D7,D8	D1F60
35	1	120082	D1	MBS340T3
36	1	120093	TVS1	SMCJ16CA
37	2	130029	TR15,TR16	BCW70
38	1	130049	TR6	S0692
39	1	130050	TR7	S0642
40	2	130055	TR11,TR13	NDT455N
41	2	130056	TR10,TR12	NDT456P
42	4	130064	TR2,TR3,TR4,TR5	DTA123YUA
43	2	130067	TR1,TR8	BC846
44	1	140068	IC8	7621
45	3	140069	IC7,IC10,IC11	LM393
46	1	140070	IC9	MC4052B
47	1	140075	IC5	PC357
48	1	140077	IC3	NMC9346
49	1	140092	REG1	TA78L05F
50	1	140096	IC1	PCAB2C250T
51	1	140147	IC6	V6300F
52	1	160075	AR1	DMT412
53	1	160066	XTAL1	9.83040MHZ
54	5	210019	S1,S2,S3,S4,S5	SM_SWITCH
55	1	E03398	IC2	PROG'D MICRO UNPROGRAMMED
				PART No. IS 140163

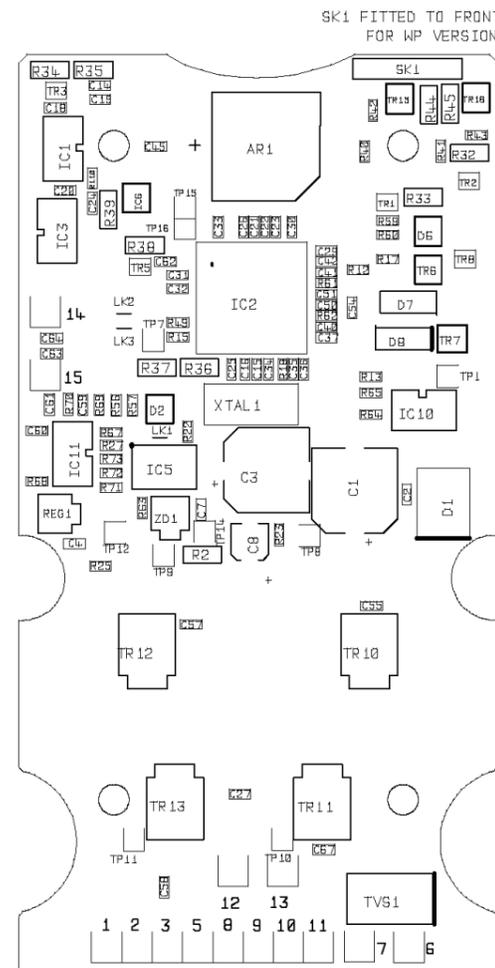
**CONVENTIONAL MOUNT COMPONENTS**

55	0.25	170078	SK1	STRIP 20 WAY
----	------	--------	-----	--------------

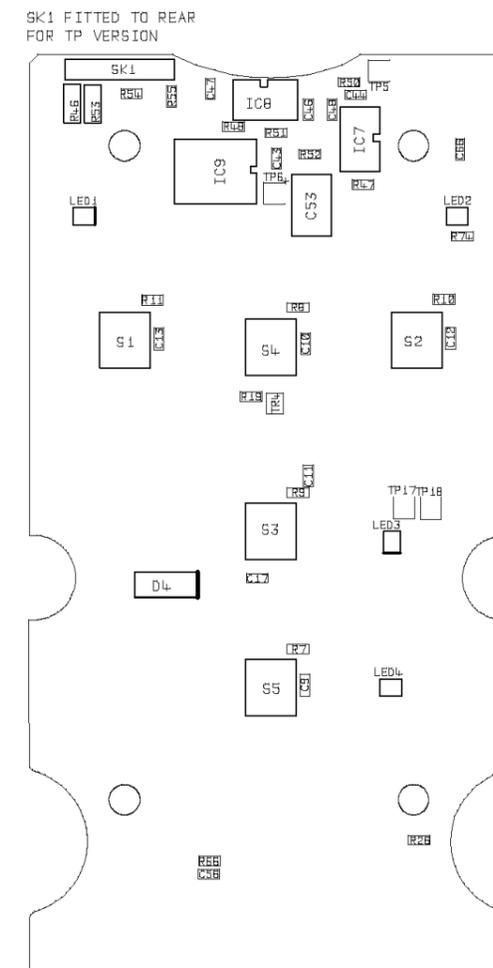
C55,C56,C57,C58 NOT FITTED

C65,C66 REFER TO CIRCUIT DIAGRAM E03372 FOR INTENDED PURPOSE.

**FRONT VIEW**



**REAR VIEW**



**LINK INFORMATION TO SELECT PRODUCT TYPE AND FUNCTIONS.**

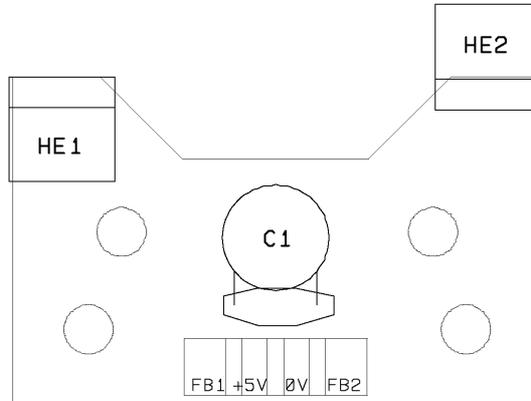
LINK 1 SELECTS BETWEEN TP & WP  
 FOR TP LINK 1 = N/C. FOR WP LINK 1 = N/D  
 LINKS 2 & 3 ARE FOR FUNCTIONS  
 FOR TP/WP20/200CX. LINK 2 = N/C. LINK 3 = N/D  
 FOR TP/WP30/300CX. LINK 2 = N/D. LINK 3 = N/D  
 FOR TP/WP10/100. LINK 2 = N/C. LINK 3 = N/C

1492	6	01-02-01	SEE MOD SHEET 1492
1444	6	1-6-00	SEE MOD SHEET 1444
1366	6	7-1-00	C43,C44 HERE 1n
1368	6	31-8-99	DRAWING MODEL & TITLE CHANGED
1202	6	12-5-98	SEE MOD 1202

<b>DO NOT SCALE</b>		<b>IF IN DOUBT ASK</b>	
		THIS DRAWING IS COMPUTER GENERATED ANY MANUAL MODIFICATION WILL INVALIDATE THE C.A.D. FILE	
STAR LAKE, MARGATE, KENT CT8 4NP TEL: 0843 280280 FAX: 0843 280471		LIMITS MET + & - 0. = .50 FRAC = .015 0.0 = .025 .00 = .010 .00 = .10 .000 = .005 ANG = 0.5 ANG = 0.5	
MODEL: WP10/WP30/TP10/TP20/TP30 (NAVICO WP300CX) (TP200CX/300CX) (NAVICO WP/TP100)		DATE: 01-02-01 SCALE: TITLE: PCB ASSEMBLY DETAIL	
DRAWN BY: R.F. DATE: 30-3-98		CHECKED: APPROVED: DATE:	
DRG No: E03178		ISSUE: 6	



DRG No: **E03184**



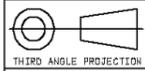
CONVENTIONAL MOUNT COMPONENTS

ITEM	QTY	PART No	COMP REF	DESCRIPTION
1	1	E03183	-	PCB DRILLED
2	1	110001	C1	100n CERAMIC DISC
3	2	140010	HE1,HE2	UGN3177U

NOTE :- PART No. E03184:TP. HE1,HE2 MOUNTED VERTICALLY.  
 PART NO. E03184:WP. HE1,HE2 MOUNTED HORIZONTALLY.

DO NOT SCALE		IF IN DOUBT ASK		1368	2	1-9-99	TP, WP DIFFERENCE NOTES ADDED DRAWING MODEL & TITLE CHANGED
 STAR LANE, MARGATE, KENT CT9 4NP TEL: 0843 290290   TELEX 965993 NAVICO G FAX: 0843 290290   FAX: 0843 290471				THIS DRAWING IS COMPUTER GENERATED ANY MANUAL MODIFICATION WILL INVALIDATE THE C.A.D. FILE		LIMITS MET + & - 0.0 = .50 .00 = .25 .00 = .10 ANG = 0.5	
MATERIAL :				MODEL : WP/TP10/30 (NAVICO WP/TP300/100)		LIMITS IMP + & - .00 = .010 .000 = .005 ANG = 0.5	
DRAWN BY: <b>R.F.</b> DATE: 30-9-97	CHECKED:	APPROVED:	DATE: 1-9-99	SCALE:	TITLE: <b>HALL EFFECT PCB ASSEMBLY DETAIL</b>	DRG No: <b>E03184</b>	ISSUE: <b>2</b>

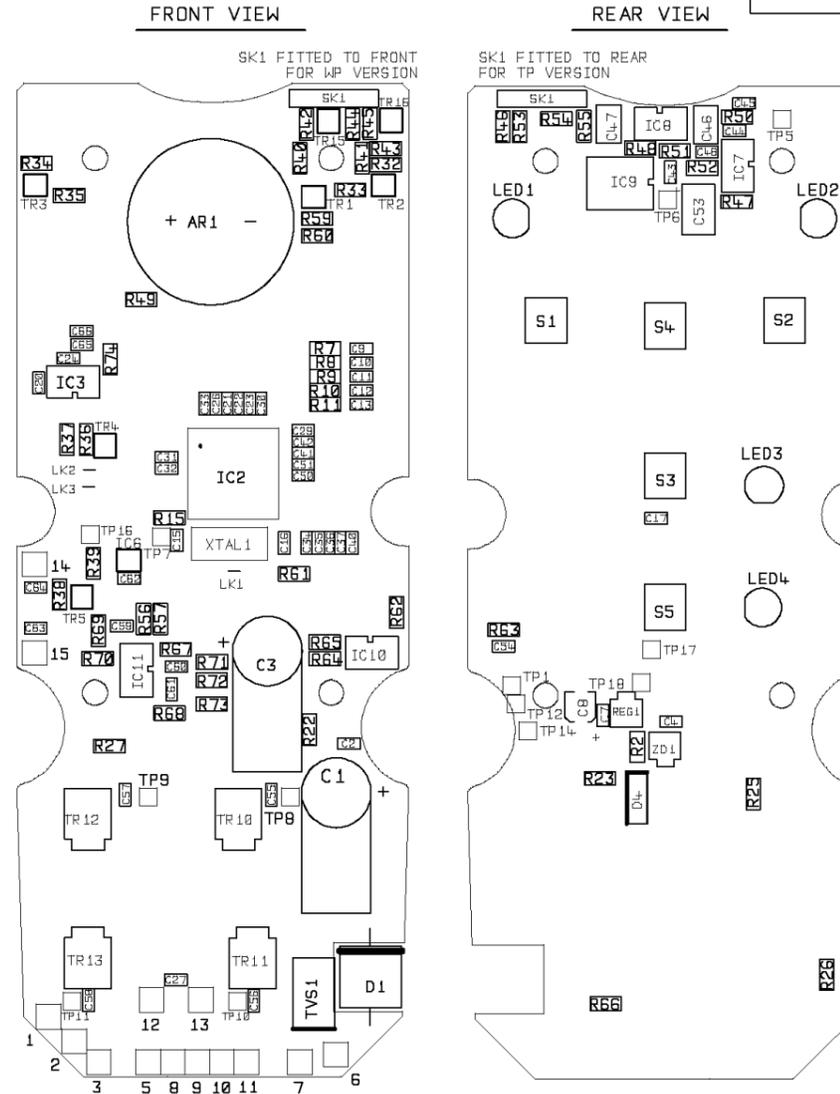




SURFACE MOUNT COMPONENTS

DRG No: E03181

ITEM	QTY	PART No	COMP REF	DESCRIPTION
1	1	E03370	-	PCB DRILLED
2	1	100125	R2	1206 10R
3	4	100128	R23,R25,R26,R66	1206 1K
4	3	100129	R51,R56,R57	1206 2K2
5	13	100131	R22,R27,R40,R41,R42,R43,R54,R55 R59,R60,R61,R65,R67	1206 4K7
6	19	100132	R7,R8,R9,R10,R11,R15,R32,R34 R36,R38,R62,R63,R64,R68,R69,R70 R71,R73,R74	1206 10K
7	7	100133	R33,R35,R37,R39,R44,R45,R53	1206 220R
8	1	100136	R50	1206 120K
9	1	100140	R49	1206 100K
10	1	100141	R46	1206 330R
11	2	100142	R48,R52	1206 680K
12	1	100216	R47	1206 33K
13	1	100219	R72	1206 27K
14	1	110104	C53	4u7 SM ELECT
15	2	110109	C46,C47	1210 4n7
16	16	110115	C9,C10,C11,C12,C13,C21,C24,C34 C35,C36,C37,C40,C41,C42,C50,C51 C15,C16	0805 22p
17	2	110116	C22,C23,C29,C30,C31,C32,C33	0805 100p
18	7	110118	C43,C44	0805 150p
19	2	110124	C2,C4,C7,C17,C20,C27,C45,C48,C60	0805 100n
20	13	110128	C61,C62,C63,C64	0805 10n
21	2	110138	C54,C59	4u7 SM ELECT
22	1	110169	C8	BZV49 30V
23	1	120038	ZD1	LL4001G
24	1	120040	D4	SMCJ16CA
25	1	120093	TVS1	NDT455N
26	2	130055	TR11,TR13	NDT456P
27	2	130056	TR10,TR12	BC846
28	1	130028	TR1	BCW70
29	2	130029	TR15,TR16	DTA123YK
30	4	130053	TR2,TR3,TR4,TR5	7621
31	1	140068	IC8	LM393
32	3	140069	IC7,IC10,IC11	MC4052B
33	1	140070	IC9	NMC9346
34	1	140077	IC3	TA78L05F
35	1	140092	REG1	V6300F
36	1	140147	IC6	9.83040MHz
37	1	160066	XTAL1	SM_SWITCH
38	5	210019	S1,S2,S3,S4,S5	PROG'D MICRO
39	1	E03398	IC2	UNPROGRAMMED PART No IS 140163



LINK INFORMATION TO SELECT PRODUCT TYPE AND FUNCTIONS.  
 LINK 1 SELECTS BETWEEN TP & WP  
 FOR TP LINK 1 = N/C, FOR WP LINK 1 = N/O  
 LINKS 2 & 3 ARE FOR FUNCTIONS  
 FOR TP/WP 10/100 FUNCTIONS, LINK 2 = N/C, LINK 3 = N/C

CONVENTIONAL MOUNT COMPONENTS

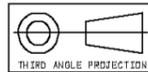
40	2	110110	C1,C3	470UF 25V ELECT
41	3	120010	LED1,LED3,LED4	L-53EC RED LED
42	1	120011	LED2	EBG5504S LED GREEN
43	1	120041	D1	6A1
44	1	160028	AR1	SM-L
45	0.25	170078	SK1	SKT STRIP 20 WAY

\* C55,C56,C57,C58 NOT FITTED  
 C65,C66 REFER TO CIRCUIT DIAGRAM E03371 FOR INTENDED PURPOSE.

DRAWN BY: R.F.  
 CHECKED: DATE: 12-5-98  
 APPROVED: DATE:

DO NOT SCALE		IF IN DOUBT ASK	
STAR LANE, MARGATE, KENT CT8 4NP TEL: 0843 280280 FAX: 0843 280271		THIS DRAWING IS COMPUTER GENERATED ANY MANUAL MODIFICATION WILL INVALIDATE THE C.A.D. FILE	
MATERIAL:		MODEL: WP/TP10 (NAVICO WP/TP100)	
DATE: 19-10-00		SCALE: N.T.S	
TITLE: PCB ASSEMBLY DETAIL		DRG No: E03181	
ISSUE: 6		ISSUE: 6	

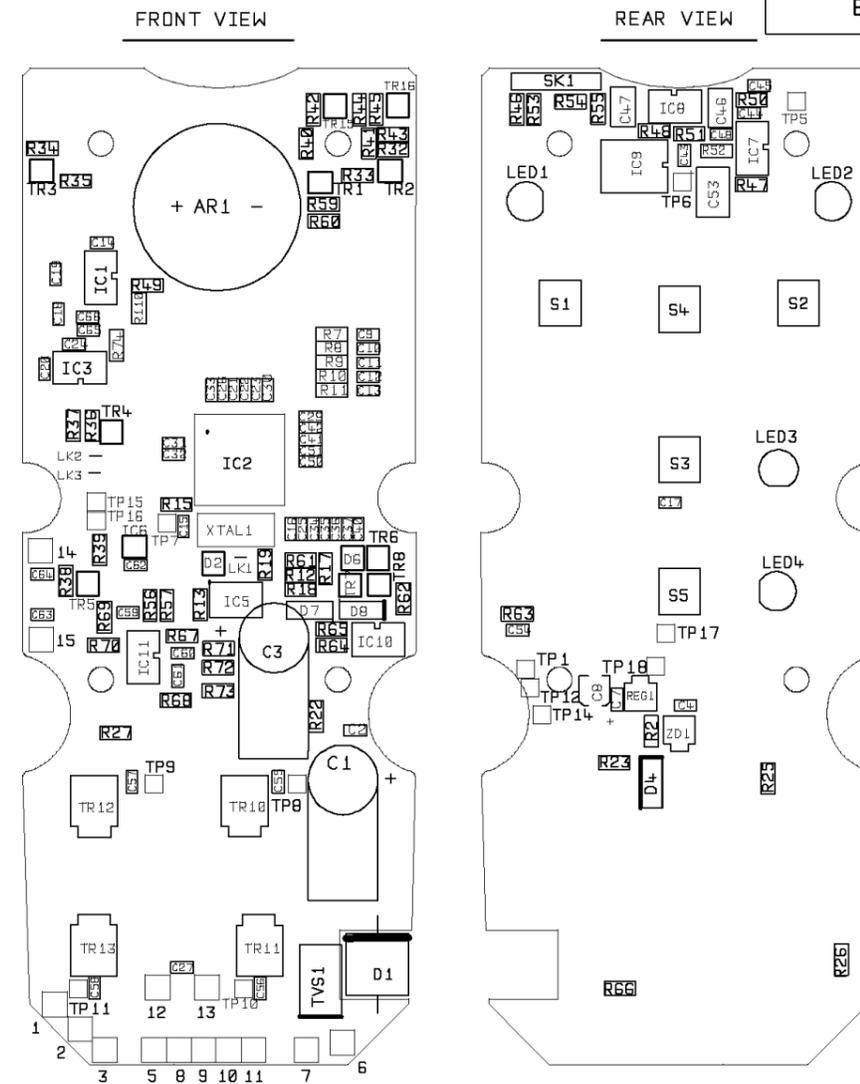




SURFACE MOUNT COMPONENTS

DRG No. E03178

ITEM	QTY	PART No	COMP REF	DESCRIPTION
1	1	E03370	-	PCB DRILLED
2	1	100124	R13	1206 470R
3	1	100125	R2	1206 10R
4	6	100128	R17,R18 ,R23,R25,R26 ,R66	1206 1K
5	3	100129	R51,R56,R57	1206 2K2
6	15	100131	R12,R19,R22,R27,R40,R41,R42,R43 R54,R55,R59,R60,R61 ,R65,R67 R7,R8,R9,R10,R11,R15,R32,R34,R36	1206 4K7
7	19	100132	R38,R62,R63,R64,R68,R69,R70,R71 R73,R74	1206 10K
8	7	100133	R33,R35,R37,R39,R44,R45,R53	1206 220R
9	1	100136	R50	1206 120K
10	2	100140	R49,R110	1206 100K
11	1	100141	R46	1206 330R
12	2	100142	R40,R52	1206 680K
13	1	100216	R47	1206 33K
14	1	100219	R72	1206 27K
15	1	110104	C53	4u7 SM ELECT
16	2	110109	C46,C47	1210 4n7
17	20	110115	C9,C10,C11,C12,C13,C18,C19,C21 C24,C25,C26,C34,C35,C36,C37 C40,C41,C42,C50,C51	0805 1n
18	2	110116	C15,C16	0805 22p
19	7	110118	C22,C23,C29,C30,C31,C32,C33	0805 100p
20	2	110124	C43,C44	0805 150p
21	14	110128	C2,C4,C7,C14,C17,C20,C27,C45,C48 C60,C61,C62,C63,C64	0805 100n
22	2	110138	C54,C59	0805 10n
23	1	110169	C8	4u7 SM ELECT
24	1	120036	D2	BAS16T
25	1	120038	ZD1	BZV49 30V
26	1	120040	D4	LL4001G
27	1	120043	D6	BAV99
28	2	120070	D7,D8	D1F60
29	1	120079	TVS1	SMCJ16A
30	2	130055	TR11,TR13	NDT455N
31	2	130056	TR10,TR12	NDT456P
32	2	130028	TR1,TR8	BC846
33	2	130029	TR15,TR16	BCW70
34	1	130049	TR6	S0692
35	1	130050	TR7	S0642
36	4	130053	TR2,TR3,TR4,TR5	DTA123YK
37	1	140068	IC8	7621
38	3	140069	IC7,IC10,IC11	LM393
39	1	140070	IC9	MC4052B
40	1	140075	IC5	PC357
41	1	140077	IC3	NMC9346
42	1	140092	REG1	TA78L05F
43	1	140096	IC1	PCAB2C250T
44	1	140147	IC6	V6300F
45	1	160066	XTAL1	9.83040MHz
46	5	210019	S1,S2,S3,S4,S5	SM_SWITCH
47	1	E03398	IC2	PRDG'D MICRO UNPROGRAMMED PART No. IS 140163



LINK INFORMATION TO SELECT PRODUCT TYPE AND FUNCTIONS.  
 LINK 1 SELECTS BETWEEN TP & WP  
 FOR TP LINK 1 = N/C, FOR WP LINK 1 = N/O  
 LINKS 2 & 3 ARE FOR FUNCTIONS  
 FOR TP/WP 20/200CX, LINK 2 = N/C, LINK 3 = N/O  
 FOR TP/WP 30/300CX, LINK 2 = N/O, LINK 3 = N/O

CONVENTIONAL MOUNT COMPONENTS

48	2	110110	C1,C3	470UF 25V ELECT
49	3	120010	LED1,LED3,LED4	L-53EC LED RED
50	1	120011	LED2	EBG5504S LED GREEN
51	1	120041	D1	6A1
52	1	160028	AR1	SM4L
53	0.25	170078	SK1	STRIP 20 WAY

C55,C56,C57,C58 NOT FITTED  
 C65,C66 REFER TO CIRCUIT DIAGRAM  
 E03372 FOR INTENDED PURPOSE.



DRAWN BY: R.F.	CHECKED:	APPROVED:
DATE 30-3-98	DATE:	DATE:

DO NOT SCALE IF IN DOUBT ASK		1366 4 7-1-00 C43,C44 WERE 1n	1368 3 31-9-99 DRAWING MODEL & TITLE CHANGED
		1202 2 12-5-98 SEE MOD 1202	
		No ISS DATE MODIFICATIONS	
SIMRAD A KINGSBURG Company	STAR LANE, MARGATE, KENT CT8 WNP TEL: 0843 280280 FAX: 0843 280471		THIS DRAWING IS COMPUTER GENERATED ANY MANUAL MODIFICATION WILL INVALIDATE THE C.A.D. FILE
	MATERIAL:	MODEL: WP30/TP20/TP30 (NAVICO WP300CX) (TP200CX/300CX)	LIMITS MET + & - 0. = .50 FRAC = .015 0.0 = .25 .00 = .010 .00 = .10 .000 = .005 ANG = 0.5 ANG = 0.5
DATE: 7-1-00	SCALE:	TITLE: PCB ASSEMBLY DETAIL	DRG No: E03178
			ISSUE: 4

**Tiller Pilot TP10, TP20 & TP30**

**Section 7**

**Programming and Configuration**

## **7 PROGRAMMING AND CONFIGURATION**

This Service Manual only contains programming and configuration information for those features of the autopilot which are not normally available to the end user. For details of normal programming and configuration please refer to the appropriate user manual.

# **Tiller Pilot TP10, TP20 & TP30**

## **Section 8**

### **Fault Finding**

## 8 FAULT FINDING

**Common User Faults.** Common user faults are included in the Diagnostics Guide included in the user manual.

**Common Technical Faults.** None yet identified.

# **Tiller Pilot TP10, TP20 & TP30**

## **Section 9**

### **Spare Parts Detail**

## 9 SPARE PARTS DETAIL

### Spares Packs

TPPK1	TP10 / 20 MECHANICAL ASSEMBLY
TPPK2	TP10 TOP CASE
TPPK3	TP20/30 BOTTOM CASE
TPPK4	TP10 PCB CASE
TPPK5	WITHDRAWN
TPPK6	FLUXGATE ASSEMBLY
TPPK7	MOUNTING PIN, CUP AND CONNECTOR
TPPK8	MOTOR ASSEMBLY
TPPK9	FEEDBACK KIT
TPPK10	DRIVE BELT
TPPK11	CASE SCREW PACK
TPPK12	PUSH ROD SEAL PACK
TPPK13	CASE SEAL PACK
TPPK14	TP100 TOP CASE
TPPK15	GREY BOTTOM CASE
TPPK16	TP20 TOP CASE
TPPK17	TP20/30 PCB CASE
TPPK18	WITHDRAWN
TPPK19	WITHDRAWN
TPPK20	TP30 TOP CASE
TPPK21	COMMON PCB ASSEMBLY
TPPK22	TP30 MECHANICAL ASSEMBLY
TPPK23	TP300CX TOP CASE
TPPK24	TP200CX TOP CASE
TPPK25	TP10 BOTTOM CASE

### 9.2 Accessories

TB30	TILLER BRACKET 30mm
TB60	TILLER BRACKET 60mm
TB90	TILLER BRACKET 90mm
TB120	TILLER BRACKET 120mm
PB30	PEDESTAL BRACKET 30mm
PB60	PEDESTAL BRACKET 60mm
PB90	PEDESTAL BRACKET 90mm
CB1	CANTILEVER BRACKET
PRE30	PUSH ROD EXTENSION 30mm
PRE60	PUSH ROD EXTENSION 60mm
PRE90	PUSH ROD EXTENSION 90mm
PRE120	PUSH ROD EXTENSION 120mm
PRE150	PUSH ROD EXTENSION 150mm
PRE300	PUSH ROD EXTENSION 300mm

### 9.3 Service Aids

TP-SRY	TILLERPILOT TEST SYRINGE
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# **Tiller Pilot TP10, TP20 & TP30**

## **Section 10**

### **Technical Notes**

## 10 TECHNICAL NOTES

PS 139	Identification of Tillerpilot variants
PS 140	Improved bonding of drive pulley to motor drive shaft
PS 173	Positioning of Feedback PCB
PS 174	Re-engineered Main PCB



## Technical Note

FOR THE ATTENTION OF THE SERVICE MANAGER

**NUMBER : PS 139**

**PRODUCT : Tillerpilot – TP100 / TP200CX /  
TP300C / TP300CX / TP10 / TP20 /  
TP30**

**SUBJECT : Identification of Variants**

**DATE : 1 October 1999**

---

There are a number of variants of Tillerpilots currently in use which, though similar in appearance, are built and operate differently. Positive identification is therefore essential when ordering spare parts to ensure that the correct item is dispatched.

The main aids to identification are:

1. Lack of a Hall Effect PCB indicates Back emf, earliest, version.
2. Hall Effect PCB with microprocessor mounted in socket indicates intermediate version.
3. Hall Effect PCB with surface mount microprocessor indicates latest version.

A table of variants identified by serial number and drawings, General Assembly, PCB Assembly and Circuit Diagram, to aid identification of the different PCBs, is given below:

TILLERPILOT VARIANTS. The Tillerpilot variants can be conveniently divided into 3 groups:

1. Feedback produced from the motor back emf.
2. Feedback produced from a Hall Effect PCB.
3. Introduction of Surface Mount microprocessor (SMu)

		TP100 Back emf	TP200CX Back emf	TP300C Back emf	TP300CX Back emf		TP100 Hall Effect	TP200CX Hall Effect	TP300CX Hall Effect		TP200CX SM u	TP300CX SM u
u No.		E02517	E02520	E02520	E02520		E03190	E03189	E03189		E03398	E03398
Man Ser No.	from	Start	Start	Start	MK3143		PE8818	PB1484	OD6415		Not Yet In Production	
	to	PE8818	PB1483	MI2954	OD6414		Continue	Continue	Continue			
Gen Assy		E02587	Not Issued	E02616	E02616		E03299	E03262	E03300			
PCB Assy		E02515	E02518	E02518	E02518		E03181	E03178	E03178			
Cct Diag		E02549	E02550	E02550	E02550		E03179	E03176	E03176			

		TP10 SM u	TP20 SM u	TP30 SM u
u No.		E03398	E03398	E03398
Man Ser No.	from	OL7635	OL1384	OL7190
	to	Continue	Continue	Continue
Gen Assy		E03504	E03505	E03506
PCB Assy		E03181	E03178	E03178
Cct Diag		E03371	E03372	E03372



## Technical Note

FOR THE ATTENTION OF THE SERVICE MANAGER

**NUMBER** : **PS 140**

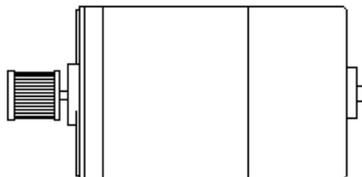
**PRODUCT** : **Tillerpilot – TP100 / TP200CX /  
TP300C / TP300CX / TP10 / TP20 /  
TP30**

**SUBJECT** : **Improved bonding of drive pulley  
to motor drive shaft.**

**DATE** : **1 October 1999**

---

The 20 Toothed Pulley Part No. E02839 is a push fit onto the motor drive shaft, see sketch below, and the bonding is enhanced with Loctite 270 Part No. 260025. Instances have occurred where the bonding has weakened resulting in reduced drive efficiency or operational failure. An improved bonding adhesive Loctite 638 Part No. 260063 has been identified and approved for use. All Tillerpilot repairs should be carried out using the new adhesive.



The new bonding agent has been used in the manufacture of all Tillerpilots with the alphabetic prefix PC, 1 March 1999, and subsequent serial numbers. The Product Support Department should be informed of any units found to be slipping post production date 1 March 1999.

# TECHNICAL BULLETIN



**NO. PS173**

**DATE: 20/06/2003**

## Tiller Pilot TP10 / TP20 / TP30

### Positioning of Feedback PCB

#### Background Information

There have recently been a small number of instances of pilots operating erratically after replacement of the Feedback PCB (TPPK9). The symptoms become more noticeable after the pilot has been operated for some time.

#### Investigation

A small number of pilots, which had had the Feedback PCB replaced, were investigated and it was found that the separation distance between the Magnets (E03208), seated in the 71 Tooth Pulley (E02505), and the Hall Effect devices (140010) was in excess of 1.5mm. The maximum separation to provide consistent switching is 0.75mm. The symptoms are exacerbated in use; heat from the motor causes a reduction in the magnet field strength further reducing positive switching.

The position of the Feedback PCB is fixed by the locating holes. Examination of a batch of PCB blanks revealed that a small proportion were out of tolerance.

#### Solution

On replacement of a Feedback PCB the separation distance should be checked to ensure that it is less than 0.75mm. If this tolerance value is exceeded then either the PCB should be replaced or alternatively the locating holes can be elongated to slots, using a round

needle file, provided care is exercised to protect the copper tracks close to the locating holes.

Further work is in hand to tighten the goods inward inspection to ensure that incoming boards meet the specification.

#### Contact Information

If you have any further queries, please contact :

*Tim Bell*  
*Product Manager, Nav & Inst*  
*Tim.bell@simrad.com*

**Simrad Margate**  
Star Lane, Margate, Kent  
CT9 4NP, United Kingdom  
Tel +44 (0) 1843 290290  
Fax +44 (0) 1843 290471

<i>Yyyy/mm/dd/Initials</i>	
<i>Please circulate to:</i>	



# TECHNICAL BULLETIN

NO. PS174

DATE: 16/07/2003

## Tiller Pilot TP10 / 20 / 30 & Wheel Pilot WP10 / 30

### Re-engineered Main PCB

#### Background Information

The main PCB used in Tiller and Wheel Pilots (E03178 Iss. 7) has been re-engineered to improve reliability and to be compatible across the product range. The TP10 & WP10 and TP20 / 30 & WP30 circuits are identical with the exception of those components concerned with NMEA and CANBUS data. A manufacturing decision was taken to employ the same board, fully populated, across the complete range of products. When the re-engineered board is used in the TP10 or WP10 those components concerned with NMEA and CANBUS data are present but not in use, these components are highlighted in Red on the attached circuit E03176.

#### Identification of Printed Circuit Boards

The original PCBs were numbered E03181, TP10 / WP10 and E03178 (Iss. 5) TP20 / 30 / WP30 (see drawings attached). The re-engineered PCB layout is different, the board is physically smaller and is identified as E03178 (Iss. 7).

#### Compatibility

Refer to the table after the drawings.

#### Essential Action on Replacement

When replacing a main PCB in any Tiller or Wheel Pilot product it is essential that the appropriate links are made in accordance with the following table:

#### LINK INFORMATION TO SELECT PRODUCT TYPE & FUNCTIONS

Link 1 selects between TP and WP

TP Link 1 = NC      WP Link 1 = NO

Links 2 & 3 provide functions

TP / WP10	Link 2 NC	Link 3 NC
TP / WP20	Link 2 NC	Link 3 NO
TP / WP30	Link 2 NO	Link 3 NO

Legend :

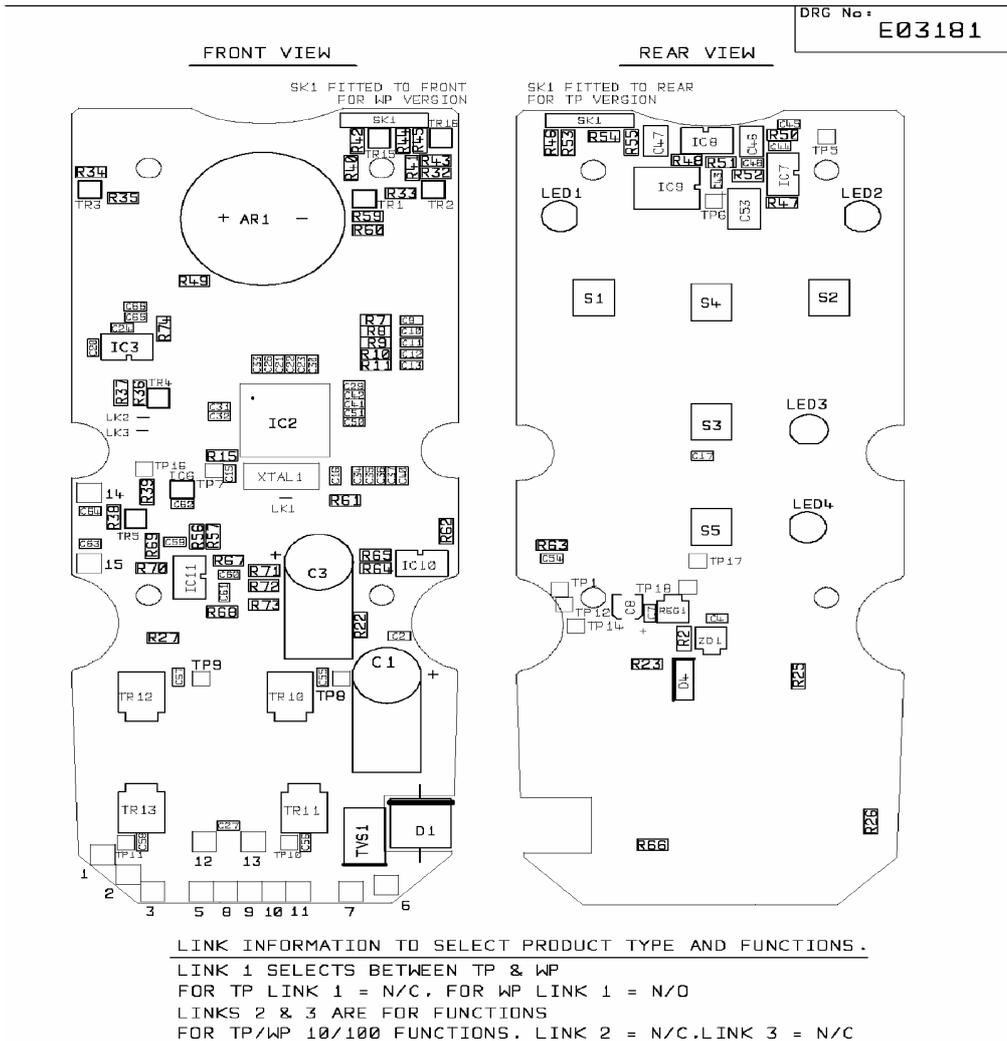
**NC** Normally Closed      **NO** Normally Open

#### Contact Information

If you have any further queries, please contact :

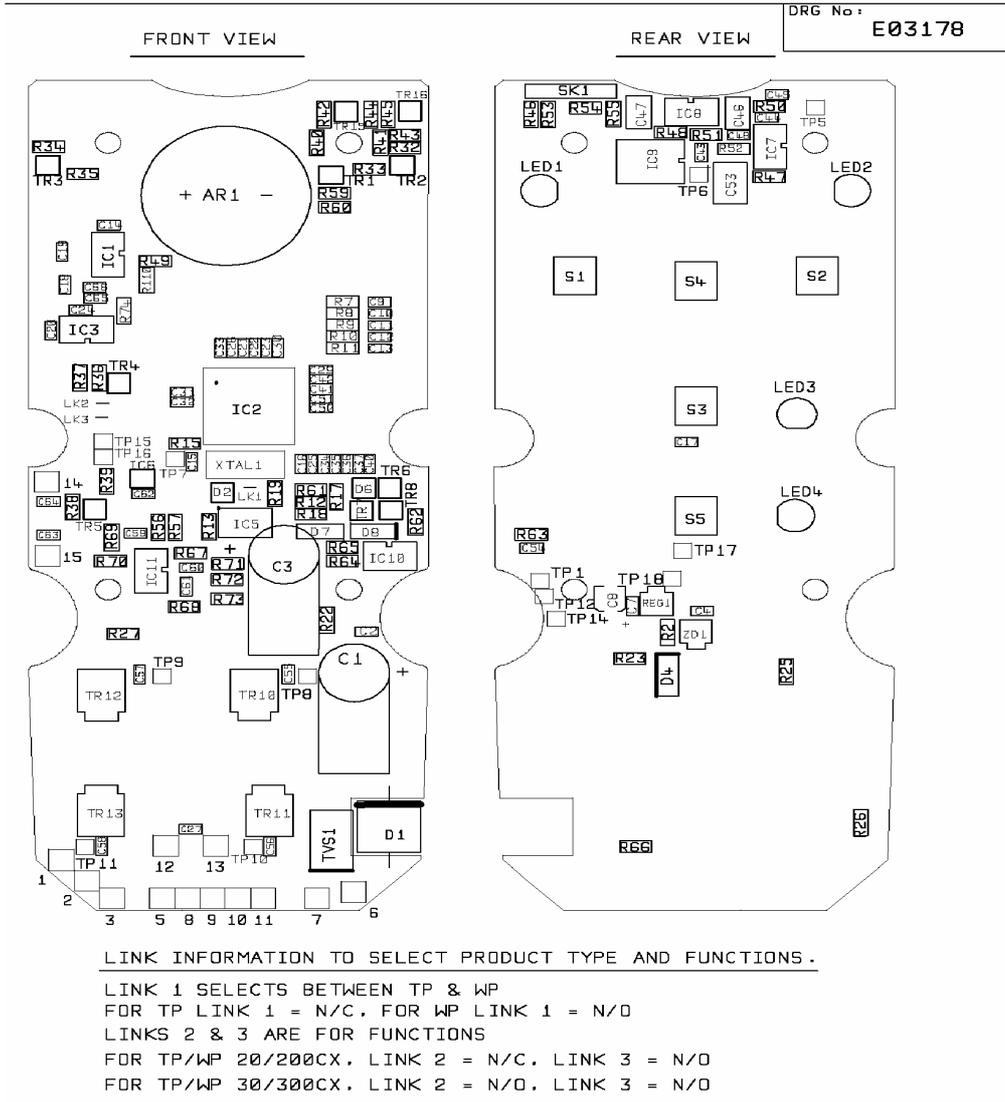
*Tim Bell*  
 Product Manage, Nav & Inst  
 Tim.bell@simrad.com  
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Yyyy/mm/dd/Initials	
Please circulate to:	



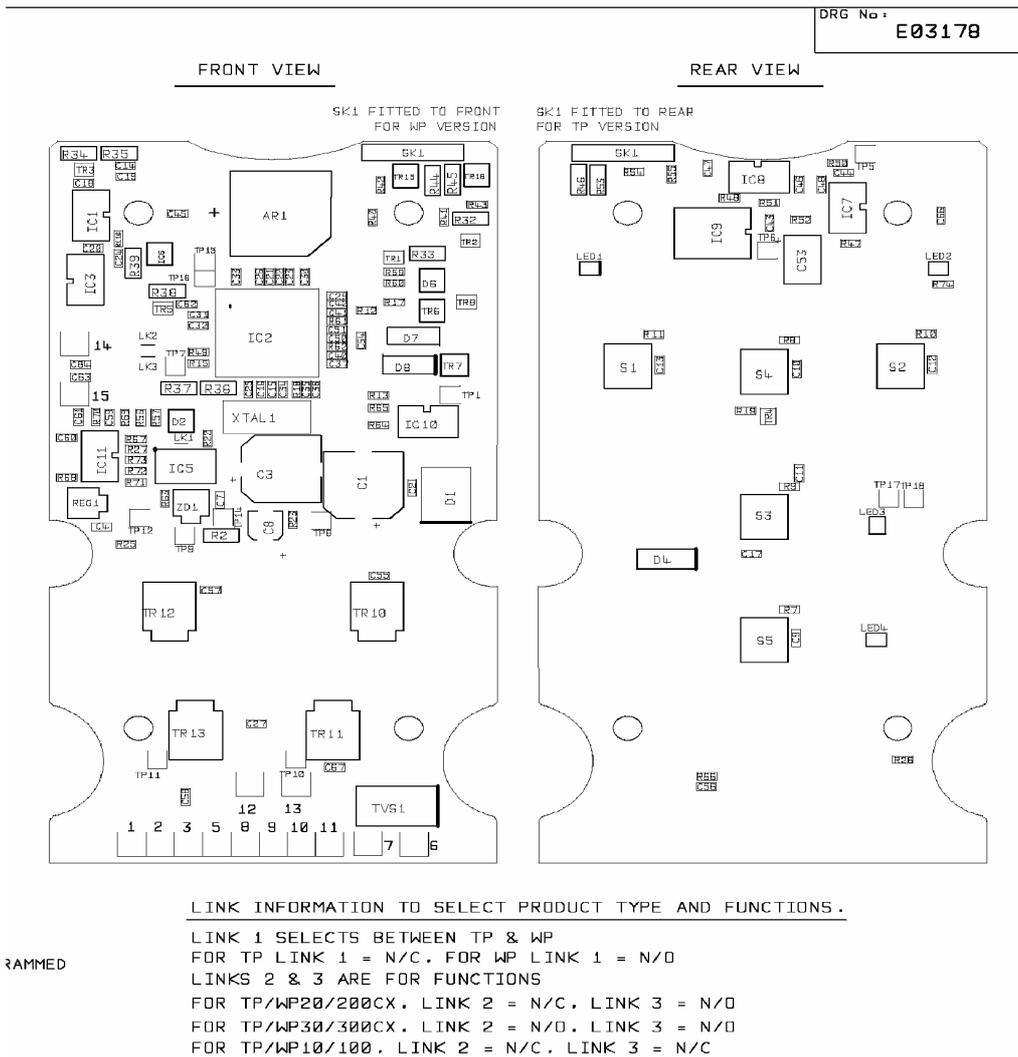
Pin Connection	Function	Colour
1 To Feedback PCB	+5v	Yellow
2 To Feedback PCB	FB1	Blue
3 To Feedback PCB	FB2	White
4 Not connected		
5 To Feedback PCB	0v	Green
6 To Supply	+V	Red
7 To Supply	-V	Black
8 Not connected	Loom not fitted in TP/WP10	
9 Not connected	Loom not fitted in TP/WP10	
10 Not connected	Loom not fitted in TP/WP10	
11 Not connected	Loom not fitted in TP/WP10	
12 To Drive Motor	M-	Blue (Black)
13 To Drive Motor	M+	Brown (Red)

**TP/WP10 OLD BOARD**



Pin Connection	Function	Colour
1 To Feedback PCB	+5v	Yellow
2 To Feedback PCB	FB1	Blue
3 To Feedback PCB	FB2	White
4 Not connected		
5 To Feedback PCB	0v	Green
6 To Supply	+V	Red
7 To Supply	-V	Black
8 Wiring Loom IN	CANBUS Lo	White
9 Wiring Loom IN	CANBUS Hi	Green
10 Wiring Loom IN	NMEA +	Yellow
11 Wiring Loom IN	NMEA -	Blue
12 To Drive Motor	M-	Blue (Black)
13 To Drive Motor	M+	Brown (Red)

**TP20/30 WP30 OLD BOARD**



RAMMED

Pin Connection	Function	Colour	Additional Info
1 To Feedback PCB	+5v	Yellow	
2 To Feedback PCB	FB1	Blue	
3 To Feedback PCB	FB2	White	
4 Not connected			
5 To Feedback PCB	0v	Green	
6 To Supply	+V	Red	
7 To Supply	-V	Black	
8 Wiring Loom IN	CANBUS Lo	White	Loom not fitted in TP/WP10
9 Wiring Loom IN	CANBUS Hi	Green	Loom not fitted in TP/WP10
10 Wiring Loom IN	NMEA +	Yellow	Loom not fitted in TP/WP10
11 Wiring Loom IN	NMEA -	Blue	Loom not fitted in TP/WP10
12 To Drive Motor	M-	Blue (Black)	
13 To Drive Motor	M+	Brown (Red)	

**NEW BOARD – ALL PRODUCTS**

**Compatibility Table**

PCB Version	Product				
	TP10	TP20	TP30	WP10	WP30
E03181	√	X	X	√	X
E03178 Pre Iss. 5	√	√	√	√	√
E03178 Iss. 5 & Subsequent	√	√	√	√	√

