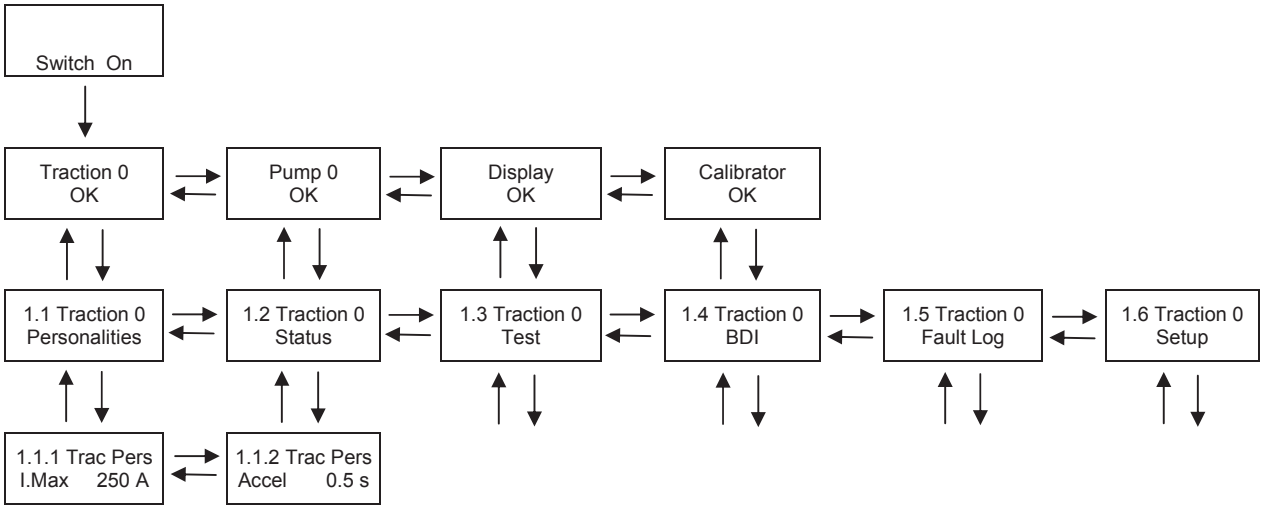
Sevcon SC2000 Calibrator Information Sheet

CALIBRATOR AND ADJUSTMENTS

A sophisticated, yet easy to use hand held adjustment unit, called the Can Calibrator is used to make adjustments to the controller and select configurations. The CAN Calibrator is also used as a diagnostic tool displaying the status of all voltages, currents and temperatures within the controller together with the condition of all the controller's switch and analogue inputs.

The diagram below describes how the CAN Calibrator is used. The left and right arrows move between screens on the same level. The up and down arrows move between levels and the + and - buttons increment or decrement the parameters by the amount indicated in the STEP column of the following tables.

The calibrator can be specified to have various levels of access to certain adjustments. A multi-language version is available for newer controllers.

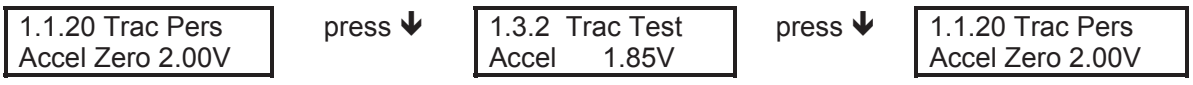


7.1.1 Traction Personalities (Controller Adjustments)

Cal.Ref	Parameter Adjusted	Min setting (all units)	Max.setting (500 A unit)	Max.setting (650 Aunit)	Step size (all units)
1.1.1	Current limit	50 A	500 A	650 A	10 A
1.1.2	Acceleration delay	0.1 s	5.0 s	5.0 s	0.1 s
1.1.3	Deceleration delay	0.1 s	0.5 s	0.5 s	0.1 s
1.1.4	Creep speed	0 %	25 %	25 %	1.0 %
1.1.5	Maximum speed	0 %	100 %	100 %	1.0 %
1.1.6	Cutback speed 1	0 %	100 %	100 %	1.0 %
1.1.7	Acceleration delay1	0.1 s	5.0 s	5.0 s	0.1 s
1.1.8	Cutback speed 2	0 %	100 %	100 %	1.0 %
1.1.9	Acceleration delay2	0.1 s	5.0 s	5.0 s	0.1 s
1.1.10	Direction Brake current	50 A	500 A	650 A	10 A
1.1.11	Neutral Brake Current	10 A (0 disables)	500 A	650 A	10 A
1.1.12	Footbrake Current	10 A (0 disables)	500 A	650 A	10 A
1.1.13	Bypass Over Current	10 A (0 disables)	750 A	970 A	10 A
1.1.14	Field Weak Pull In	50 A	500 A	650 A	10 A
1.1.15	Field Weak Drop Out	50 A	500 A	650 A	10 A
1.1.16	Power Steer Delay	0 s	50 s	50 s	1.0 s
1.1.17	Seat Switch Delay	0 s	5.0 s	5.0 s	0.1 s
1.1.18	Regen Time	0 ms (0=plug only)	350 ms	350 ms	10 ms
1.1.19	Brake Constant Factor	0	25.5	25.5	0.1
1.1.20	Accelerator Zero Level	0 V	5.5 V	5.5 V	0.02 V
1.1.21	Accelerator Full Level	0 V	5.5 V	5.5 V	0.02 V
1.1.22	Footbrake Pot Zero Level	0 V	5.5 V	5.5 V	0.02 V
1.1.23	Footbrake Pot Full Level	0 V	5.5 V	5.5 V	0.02 V
1.1.24	Economy Pot Zero Level	0 V	5.5 V	5.5 V	0.02 V
1.1.25	Economy Pot Full Level	0 V	5.5 V	5.5 V	0.02 V
1.1.26	Steer Pot left Level	0 V	5.5 V	5.5 V	0.02 V
1.1.27	Steer Pot right Level	0 V	5.5 V	5.5 V	0.02 V
1.1.28	Speed Limit	0 KPH (0 disables)	60 KPH	60 KPH	1 KPH
1.1.29	Dual Motor Inner Angle	5 °	85 °	85 °	1.0 °
1.1.30	Dual Motor Inner Ramp	0.1 s	5.0 s	5.0 s	0.1 s
1.1.31	Dual Motor Outer Angle	5°	85 °	85 °	1.0 °
1.1.32	Dual Motor Outer Ramp	0.1 s	5.0 s	5.0 s	0.1 s
1.1.33	Inch Speed	0 %	25 %	25 %	1 %
1.1.34	Burst Inch Delay	0 s	5.0 s	5.0 s	0.1 s
1.1.35	Bypass Delay	0.0 s	5.0 s	5.0 s	0.1 s
1.1.36	Plugging Threshold	50	255	255	1.0

Note 1: Depending on controller type and configuration some of the above may not be displayed.

Note 2: pressing the calibrator “down arrow” key from the potentiometer zero and full personalities (1.1.20 to 1.1.27, and 2.1.23 to 2.1.24) jumps directly to the associated voltage measurement in the test menu. Pressing this key from the test menu jumps back to the associated zero level personality. For example:



7.1.2 Traction Status Information

Cal.Ref.	Parameter Displayed	Min.Display	Max.Display	Step size	Log Info.
1.2.1	Battery Voltage	0 V	127 V	0.1 V	+
1.2.2 L/R	Traction Motor Voltage	0 V	127 V	0.5 V	
1.2.3 L/R	Traction Motor Current	0 A	1200 A	6 A	+
1.2.4 L/R	Traction Controller Temp.	-30 °C	+225 °C	1 °C	+ -
1.2.5 L/R	Traction Mosfet Voltage	0 V	127 V	0.5 V	
1.2.6	Capacitor Voltage	0 V	127 V	0.5 V	
1.2.7	Speed Sensor Indication	0 KPH	60 KPH	1.0 KPH	
1.2.8	Key Switch Hours Count	0 Hrs	65279.9 Hrs	0.1 Hrs	
1.2.9	Traction Pulsing Hours Count	0 Hrs	65279.9 Hrs	0.1 Hrs	
1.2.10	Pump Contactor Hours Count	0 Hrs	65279.9 Hrs	0.1 Hrs	
1.2.11	Work Hours (Trac. or Pump)	0 Hrs	65279.9 Hrs	0.1 Hrs	
-	Service Log Reset	press + followed by - to reset service log			

Note 1: On Dual Motor Controllers L and R denote two displays for both left and right motors.
Note 2: Log Info shows where the + and - keys can be used to access the service max and min data.

7.1.3 Traction Test Information

Cal.Ref	Input Displayed		Min. Display	Max. Display	Step Size
1.3.1	Accelerator %	Range	0 %	100 %	1 %
1.3.2	Accelerator Voltage	Range	0.0 V	5.7 V	0.1 V
1.3.3	Footbrake Pot. %	Range	0 %	100 %	1 %
1.3.4	Footbrake Pot. Voltage	Range	0.0 V	5.7 V	1 V
1.3.5	Economy Pot. %	Range	0 %	100 %	1 %
1.3.6	Economy Pot. Voltage	Range	0.0 V	5.7 V	0.1 V
1.3.7	Dual Motor Steer Pot. %	Range	0 %	100 %	1 %
1.3.8	Dual Motor Steer Pot. V	Range	0.0 V	5.7 V	0.1 V
1.3.9	Forward	Switch	Open	Closed	-
1.3.10	Reverse	Switch	Open	Closed	-
1.3.11	FS1	Switch	Open	Closed	-
1.3.12	Seat	Switch	Open	Closed	-
1.3.13	Handbrake	Switch	Open	Closed	-
1.3.14	Speed Cutback 1	Switch	Open	Closed	-
1.3.15	Speed Cutback 2	Switch	Open	Closed	-
1.3.16	Power Steer Trigger Input	Switch	Open	Closed	-
1.3.17	Inch Forward	Switch	Open	Closed	-
1.3.18	Inch Reverse	Switch	Open	Closed	-
1.3.19	Dual Motor Inner Left	Switch	Open	Closed	-
1.3.20	Dual Motor Inner Right	Switch	Open	Closed	-
1.3.21	Dual Motor Outer	Switch	Open	Closed	-
1.3.22	Pump Contactor Trigger	Switch	Open	Closed	-
1.3.23	Software Version/Revision		000.00	999.99	-
1.3.24	Controller Serial Number		00000000	99999999	-

Note: As with the personalities, only relevant switch tests will be shown.

7.1.4 BDI Adjustments (if enabled in setup menu)

Cal.Ref.	Parameter Adjusted/Displayed	Min Setting	Max. Setting	Step Size.
1.4.1	xxx % Charge remaining	display only		
1.4.2	Battery Volt xx V	24 V	96 V	2 V
1.4.3	Reset x.xx V/Cell	2.00 V/Cell	2.50 V/Cell	0.01 V/Cell
1.4.4	Empty x.xx V/Cell	1.50 V/Cell	1.99 V/Cell	0.01 V/Cell
1.4.5	Warning xx %	0 %	90%	1.0 %
1.4.6	Cutout xx %	0 %	90%	1.0 %

7.1.5 Fault Log

Can be disabled via setup menu. See section 9 for more details.

7.1.6 Setup Menu (Enables/Disables features)

Cal.Ref.	Feature	Options
1.6.1	Contactor Chopping	24 V / On / Off
1.6.2	Accelerator Type	Linear / Curved / 2* Slope/ Crawl
1.6.3	BDI	On / Off
1.6.4	Power Steer Trigger	None to FS1+Dir+Brake+Seat
1.6.5	Economy Cuts Traction Current	On / Off
1.6.6	Bypass in Current Limit	On / Off
1.6.7	SRO	On / Off
1.6.8	Braking	Proportional / Constant
1.6.9	Seat Switch Cuts Pump	On / Off
1.6.10	Fault Log	On / Off
1.6.11	Service Log	On / Off
1.6.12	Node Number	0 to 15
1.6.13	Full Speed	5 to 60 KPH in 1 KPH steps
1.6.14	Probe Frequency	10 to 200 Hz in 1 Hz steps
1.6.15	Cut2 Lmt Spd	On / Off
1.6.16	Fixed plugging	On / Off

Note: Changes only take effect after a key-switch recycle

7.2.1 Pump Personalities (Controller Adjustments)

Cal.Ref	Parameter Adjusted	Min setting (all units)	Max.setting (500 A units)	Max.setting (650 A units)	Step size (all units)
2.1.1	Current Limit	50 A	500 A	650 A	10 A
2.1.2	Ramp Up Delay	0.1 s	5.0 s	5.0 s	0.1 s
2.1.3	Ramp Down Delay	0.1 s	0.5 s	0.5 s	0.1 s
2.1.4	Creep Speed	0 %	25 %	25 %	1.0 %
2.1.5	Pump Speed 1	0 %	100 %	100 %	1.0 %
2.1.6	Pump Compensation 1	1 % (0 disables)	200 %	200 %	1.0 %
2.1.7	Pump Speed 2	0 %	100 %	100 %	1.0 %
2.1.8	Pump Compensation 2	1 % (0 disables)	200 %	200 %	1.0 %
2.1.9	Pump Speed 3	0 %	100 %	100 %	1.0 %
2.1.10	Pump Compensation 3	1 % (0 disables)	200 %	200 %	1.0 %
2.1.11	Pump Speed 4	0 %	100 %	100 %	1.0 %
2.1.12	Pump Compensation 4	1 % (0 disables)	200 %	200 %	1.0 %
2.1.13	Pump Speed 5	0 %	100 %	100 %	1.0 %
2.1.14	Speed 5 (Priority/Additive)	priority	additive	additive	-
2.1.15	Pump Speed 6	0 %	100 %	100 %	1.0 %
2.1.16	Speed 6 (Priority/Additive)	priority	additive	additive	-
2.1.17	Pump Speed 7	0 %	100 %	100 %	1.0 %
2.1.18	Speed 7 (Priority/Additive)	priority	additive	additive	-
2.1.19	Power Steer Speed	0 %	100 %	100 %	1.0 %
2.1.20	Power Steer Compensation	1 % (0 disables)	200 %	200 %	1.0 %
2.1.21	Power Steer Ramp Up Delay	0.1 s	5.0 s	5.0 s	0.1 s
2.1.22	Power Steer Ramp Down Delay	0.1 s	0.5 s	0.5 s	0.1 s
2.1.23	Accelerator Zero Level	0.0 V	5.5 V	5.5 V	0.02 V
2.1.24	Accelerator Full Level	0.0 V	5.5 V	5.5 V	0.02 V

7.2.2 Pump Status Information

Cal.Ref	Parameter Displayed	Min. Display (all units)	Max.Display (all units)	Step size (all units)	Log Info.
2.2.1	Battery Voltage	0 V	127 V	0.1 V	+
2.2.2	Pump Motor Voltage	0 V	127 V	0.5 V	
2.2.3	Pump Motor Current	0 A	1200 A	6 A	+
2.2.4	Pump Controller Temp.	-30 °C	+225 °C	1 °C	+ -
2.2.5	Pump Mosfet Voltage	0 V	127 V	0.5 V	
2.2.6	Capacitor Voltage	0 V	127 V	0.5 V	
2.2.7	Key Switch Hours Count	0 Hrs	65279.9 Hrs	0.1 Hr (6min)	
2.2.8	Pump Pulsing Hours Count	0 Hrs	65279.9 Hrs	0.1 Hr (6min)	
2.2.9	Work Hours Count	0 Hrs	65279.9 Hrs	0.1 Hr (6min)	

Note : Log Info shows where the + and - keys can be used to access the service max and min data.

7.2.3 Pump Test Information

Cal.Ref.	Input Displayed	Min.Display (all units)	Max.Display (all units)	Step size (all units)
2.3.1	Accelerator % Range	0 %	100 %	1 %
2.3.2	Accelerator Voltage Range	0.0 V	5.7 V	0.1 V
2.3.3	Pump Switch 1	Open	Closed	-
2.3.4	Pump Switch 2	Open	Closed	-
2.3.5	Pump Switch 3	Open	Closed	-
2.3.6	Pump Switch 4	Open	Closed	-
2.3.7	Pump Switch 5	Open	Closed	-
2.3.8	Pump Switch 6	Open	Closed	-
2.3.9	Pump Switch 7	Open	Closed	-
2.3.10	Pump Inhibit Switch	Open	Closed	-
2.3.11	Seat	Open	Closed	-
2.3.12	Software Version/Revision	000.00	999.99	-
2.3.13	Controller Serial Number	00000000	99999999	-

7.2.4 Pump BDI (as Traction 7.1.4, but only present in standalone Pump units)

7.2.5 Pump Fault Log (as Traction 7.1.5, but only present in standalone Pump units)

7.2.6 Pump Setup Menu Enables/Disables features

Cal.Ref.	Feature	Options
2.6.1	Contactor Chopping	24 V / On / Off
2.6.2	BDI	On/Off
2.6.3	Power Steer Trigger	None to FS1+Dir+Brake+Seat
2.6.4	Seat Switch Cuts Pump	On / Off
2.6.5	Fault Log	On / Off
2.6.6	Service Log	On / Off
2.6.7	Node Number	0 to 15
2.6.8	Only Cut PS1	On / Off

Note: changes only take effect after a key-switch recycle.

7.3.1 Traction and Pump adjustment descriptions

Adjustment		Description (T=Affects traction, P=Affects Pump)
Current Limit	T+P	Maximum allowable motor current.
Acceleration Delay	T+P	Time taken to ramp up from 0 to 100% on.
Deceleration delay	T+P	Time taken to ramp down from 100% to 0% on.
Creep Speed	T+P	Minimum applied % on when drive first selected. Only PS1 on pump
Maximum Speed	T	Maximum allowable % on.
Cutback Speeds 1&2	T	Maximum allowable % on when cutback switches active.
Accel. Delay 1&2	T	Independently adjustable acceleration delays during speed cutbacks.
Dir. Brake Current	T	Maximum braking current during direction switch change.
Footbrake Current	T	Maximum braking current in neutral when F.brake switch active.
Neut. Brake Current	T	Maximum braking current in neutral.
Bypass Over Current	T	Maximum allowable current in Bypass before contactor opens.
F.W. Pull In Current	T	F.Weak. contactor allowed to pull in at currents < pull in level.
F.W Drop out Current	T	F.Weak. contactor will drop out at currents > drop out level.
Power Steer Delay	T	Delay after power steer trigger removed until contactor opens.
Seat Switch Delay	T	Delay after seat switch opens until pulsing is inhibited.
Regen Time	T	Used to minimise delays for unsuccessful regen attempts at lowspeeds. Higher numbers give regen at lower speeds. 0 forces plugging only.
Brake Factor	T	Multiplication factor used to scale regen currents into end plug currents to improve regen to plug transition. E.g. Regen direction brake current =100A, Brake Factor=0.8, Plug current at end of braking cycle=80A
Zero Levels	T+P	Used to select minimum voltage input level for function. E.g. an Accel Zero level=0.5V means traction pulsing begins at 0.5V I/P
Full Levels	T+P	Used to select maximum voltage input level for function, E.g. an Accel Full Level of 4.0v means 100% pulsing is reached at 4V I/P
Speed Limit	T	Used with external speed sensor to provide speed limit feature.
D.Motor Inner Angle	T	Sets start of inner motor cut band. Typically 45° for non-proportional systems and 10 ° for proportional systems.
D.Motor Outer Angle	T	Sets start of inner motor reverse band. Typically 75° for non-proportional systems and (90 - $\tan^{-1}$(track / (2.wheelbase))) ° for proportional systems.
D.Motor Inner Ramp	T	Time taken to ramp up pulsing after inner motor drop out on any Dual Motor Non Proportional system
D.Motor Outer Ramp	T	As above, except ramp up time after inner motor reversal.
Inch Speed	T	Maximum allowable % on during inching operation.
Burst Inch Delay	T	Timer to allow inching for a set period only.
Bypass delay	T	Time for Bypass contactor to close after 100% on reached
Pump speeds 1-7	P	Maximum allowable % on's when respective switch active
Power Steer Speed	P	As above, but for Power Steer speed.
Pump Comp. 1-4	P	Set-up compensation by adjusting the relevant pump speed to give the required minimum no load speed, then set the associated compensation adjustment to give the same speed under full load conditions
Power Steer Comp.	P	As above but for Power Steer speed compensation.
Power Steer Ramp up	P	Independent acceleration delay for power steer function.
P. Steer Ramp down	P	As above but deceleration delay.
Speed 5-7 Priority/Additive	P	Lower numbers have priority over higher numbers. Additive is where the speeds 5-7 are added to lower numbered switches.

7.3.2 BDI adjustment descriptions

BDI Adjustment		Description
Charge remaining		Displays the remaining battery charge. This is a display only, no adjustments can be made.
Battery Voltage		Adjustment used to enter the nominal battery voltage
Reset Volts/Cell		Sets the voltage at which the BDI resets to 100% at power up. E.g. the BDI will reset to 100% on a 48V system, with the reset adjustment set to 2.20 Volts per cell, if the battery voltage is above 52.8V. (48V/2)*2.20V
Empty Volts/Cell		Sets the voltage at which the BDI indicates the battery is fully discharged E.g. the BDI will eventually show 0% on a 48V system, with the empty adjustment set to 1.60 Volts per cell, if the battery voltage is below 38.4V. (48V/2)*1.60V
Warning Level %		Sets the discharged level at which the warning threshold is reached, at which point the remaining lit segments flash.
Cutout Level %		Sets the discharged level at which the cut-out threshold is reached, at which point all the segments flash together and the cutout action, Pump cutout and Traction speed 2 limit initiated.

7.3.3 Setup Menu Descriptions

Setup menu Option		Description
Contactor Chopping	T&P	**24V/On/Off** - Set to **24V** to obtain 24V across coils when a lamp is also being driven, **On** when just contactor coils are being driven and **Off** when battery voltage contactor coils are used.
Accelerator type	T	**Linear/Curved/2*slope/Crawl** - Set to **Linear** for a straight line accelerator characteristic, Curved for more low speed manoeuvrability, **2*Slope** for a balance between Linear and Curved, and **Crawl** for a very shallow low speed manoeuvrability curve. See graph 2 appendix.
BDI	T&P	**On/Off - On** enables the BDI (Battery Discharge Indicator) and any warning/cutout settings, **Off** disables the BDI feature and removes the BDI setup menu display.
Power Steer Trigger	T&P	**None/FS1/Dir/F+D/Brake/F+B/D+B/F+D+B/Seat/F+S/D+S/F+D+S/B+S/F+B+S/D+B+S/F+D+B+S/Pulsing** - These are the various triggers for power steer activation, **FS1 or F** = FS1 switch, **Dir or D** = Direction switch, **Brake or B** = Foot brake switch and **Seat or S** = Seat switch, e.g. setting to FS1 will trigger the power steer delay only when FS1 is closed, whilst setting to F+D+B will trigger the delay when either FS1 or Direction or the Brake switches are closed. Pulsing activates the power steer when traction **or** pump is pulsing.
Economy cuts traction current	T	**On/Off** - set to **On** for current limit to be reduced during economy or **Off** for just the standard acceleration delay increase.
Bypass in current limit	T	**On/Off - On** = Bypass at max %on and current limit, **Off** = just Bypass at max %on.
SRO	T	**On/Off - On** = SRO enabled, **Off** = SRO disabled
Braking	T	**Prop/Const - Prop** = Direction braking level is proportional to accelerator position, **Const** = Direction braking is constant level.
Seat switch cuts pump	P	**On/Off - On** = Seat switch cuts Traction and Pump, **Off** = just Trac.
Fault Log	T&P	**On/Off - On** = Fault Log enabled, **Off** = Disabled and no display.
Service Log	T&P	**On/Off - On** = Service Log enabled, **Off** = Disabled and no display.
Node Number		**0-15** - Normally set to 0. With a multi controller CAN bus system set one controller to 0 to be the master for controlling the display and set the other controllers **1,2,3.....15.**
Only Cut PS1	P	**On/Off** - **On =** BDI cutout only inhibits PS1, **Off =** BDI cutout inhibits PS1 to PS7.
Cut2 Lmt Spd	T	**On/Off - On =** Speed Limit is only active when Speed Cutback2 is active. **Off =** Speed Limit is active at all times. Note Speed limit is totally disabled if Speed Limit is set to 0 KPH.

8 DIAGNOSTICS

Traction and Pump Fault Messages and LED status/number of flashes

	Calibrator Message	Standard Display	Full Feature Display	Led	Description and how to clear	Check...
0	OK (lowest priority)			on	Traction operational and OK.	No action required.
1	Testing...	Run Tests		on	Only displayed briefly at power up.	No action required.
2	BDI Cutout	BDI Cut	BDI CUT OUT	7F	BDI enabled and cutout action initiated.	Battery charged.
3	Thermal Cutback	Over Temp.	TRAC HOT	8F	Traction heatsink above 75°C. Allow controller to cool.	Heatsinking, Mounting, Surfaces clean, fan req.
4	Speed Probe	Speed Probe	SPEED PROBE	6F	Speed limit feature enabled & wire off.	Probe connections.
5	Accel. Fault	Accel Fault	ACCEL FAULT	6F	Accel. pedal pressed at power up, or wire off. Recycle FS1 and Direction.	Accel wiring. Accel Zero & Full Personalities.
6	Contactor o/c	Cont o/c	CONTACT FAULT	4F	Contactor has bad contact or didn't close, motor o/c. Recycle FS1 & Dir.	Coil wiring, power wiring, motor o/c.
7	Contactor s/c	Cont s/c	CONTACT FAULT	4F	Contactor didn't open or is welded. Recycle FS1 and Direction switch.	Welded tips, particles in tips, wiring.
8	Steer Pot Fault	Steer Fault	STEER FAULT	6F	Wire off steer pot input.	Steer pot wiring
9	Sequence Fault	Seq. Fault	SEQ FAULT	2F	Direction or FS1 switch at power up. Recycle Direction FS1 or both.	Dir and FS1 in neutral and Dir/FS1 wiring.
10	2 Dir. Fault	2 Dir Fault	2 DIR FAULT	2F	Two directions selected together. Recycle both Directions and FS1.	Direction switch wiring.
11	SRO Fault	SRO Fault	SRO FAULT	2F	Dir. switch selected > 2 secs after FS1. Recycle FS1 and Dir.	Dir first then FS1, FS1 and Dir. switch wiring.
12	Seat Fault	Seat Fault	SEAT FAULT	2F	Drive selected and no seat sw. Recycle Dir and FS1 switch	Seat switch, closed, seat wiring.
13	Inch Fault	Inch Fault	INCH FAULT	2F	Inch switch at power up , both inch switches selected or inching attempted with seat switch or Dir/FS1 selected. Recycle inch switches.	Inch switch in neutral at power up, only 1 selected, Seat/Dir/FS1 switches open.
14	Steer Fault	Steer Fault	STEER FAULT	2F	Outer switch closing before inner.	Switch operation/wiring.
15	Battery Low	Bat. Low	BATTERY LOW	7F	Battery < Low battery personality. Recycle FS1 or Direction switch	Correct battery voltage, Discharged battery.
16	Battery High	Bat. High	BATTERY HIGH	7F	Battery > High battery personality. Recycle FS1 or Direction switch	Correct battery voltage. Loose or missing B+ to controller.
17	Pers Error	Pers Error	PERS ERROR	1F	Personalities out of range at power up.	Reset personalities out of range (shown as ----.-).
18	CRC error	CRC Error	CRC ERROR	1F	One or more personalities have been corrupted.	Check **all** personalities then recyclekKeyswitch.
19	Coil s/c	Coil s/c	COIL FAIL	9F	A contactor coil s/c or miswired. Recycle Keyswitch	coil s/c, Drive connected directly to B+ve, wiring.
20	Mosfet s/c	FET s/c	MOSFET FAIL	3F	Bypass contactor s/c or Mosfet s/c Recycle FS1 or Direction	F1/F2 /B- power wiring, Mosfets s/c.
21	Various internal controller power up messages (highest priority)	FAIL	FAIL	off	If any of these message are displayed then the controller has failed one of its internal power up checks.	Contact Sevcon.

9 SERVICE AND FAULT LOGS

The Service and Fault Logs have been incorporated to allow end users and service personnel to inspect and note the controller's performance and fault history. Utilising the controller's existing Status measurements and Diagnostics capabilities, information (such as the maximum temperature the controller has operated at or the number and type of faults that have been detected) can be stored in non-volatile memory and presented at a later date. Both the Service and Fault logs can be selected/deselected via the setup menu on the calibrator, and when selected can be cleared at any time to start recording new data.

9.1 Service Log

Service information is available in the Traction and Pump Status menus, where holding down the '+' key shows the maximum value of the current item, and holding down the '-' key shows the minimum value. The following items are logged:

- Maximum Battery Voltage
- Maximum Motor Current
- Maximum Controller Temperature and Minimum Controller Temperature.

To clear the log, access the "Service Log + to reset log" message at the end of the Status menu, and follow the prompts. The service log can be enabled and disabled in the Setup menu.

9.2 Fault Log

The Fault log is available at location 1.5 on the calibrator. Faults are grouped together by "LED flash fault"; the types of flash fault and whether each is logged is shown below. Generally faults that can occur during normal operation, e.g. a 2 flash driver procedure error or an 8 flash thermal cutback indication, are not logged.

- LED off faults	Logged	(Internal controller power up check faults)
- 1 flash faults	Logged	(Personality/CRC faults)
- 2 flash faults	Not Logged	(Driver procedure/sequence/wiring type faults)
- 3 flash faults	Logged	(Mosfet/Bypass wiring type faults)
- 4 flash faults	Logged	(Contactor o/c or s/c or wiring type faults)
- 5 flash faults	Not Logged	(Not used)
- 6 flash faults	Logged	(Potentiometer wire off type faults)
- 7 flash faults	Logged	(Battery low or high faults)
- 8 flash faults	Not Logged	(Thermal cutback faults)
- 9 flash faults	Logged	(Contactor coil s/c type faults)

Each of the above logged categories contains - The total number of faults of this type, the Key hours count of the most recent fault and a text description of the fault. An example of how the Fault Log information is presented is shown below:

12*04F 12345.6hr Contactor o/c

This display shows that 12 4-Flash faults have occurred and been logged, the most recent at 12345.6 Key hours and it was a Contactor o/c fault.

Once into the fault log menu, the left and right arrows are used to view any faults stored and at the end of the list a "Fault Log + to reset log" message is shown, where the Fault Log can be reset in a similar way to the service log. The Fault Log can be enabled and disabled in the setup menu.