Sevcon PowerPak Calibrator Instruction Sheet

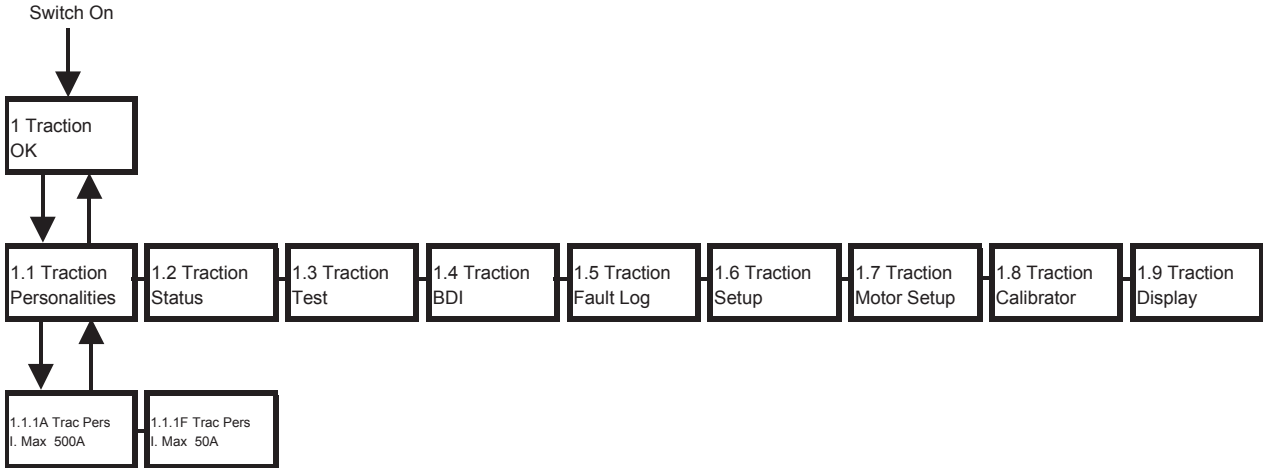
CALIBRATOR AND ADJUSTMENTS

A sophisticated, yet easy to use hand held adjustment unit, called the Calibrator is used to make adjustments to the controller and select configurations. The 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 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.

Calibrator Menu – Top Level



7.1.1 Traction Controller Personalities (Controller Adjustments)

Cal. Ref.	Parameter Adjusted	Min Adjust (All units)	Max. Adjust (200A unit)	Max. Adjust (270A unit)	Max. Adjust (350A unit)	Max. Adjust (500A unit)	Step Size all units	Typical Default
1.1.1A	Current limit Armature	50 A	200 A	270 A	350 A	500 A	10 A	100% A
1.1.1F	Current limit Field	10 A	30 A	30 A	50 A	50 A	1 A	100% A
1.1.2	Acceleration delay	0.1 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1 S	1.5 S
1.1.3	Deceleration delay	0.1 S	0.5 S[2]	0.5 S[2]	0.5 S[2]	0.5 S[2]	0.1 S	0.3 S
1.1.4	Creep speed	0 %	25 %	25 %	25 %	25 %	1.0 %	5.0 %
1.1.5	Direction Regen Current[3]	50 A	200 A	270 A	350 A	500 A	10 A	180 A
1.1.5	Direction Regen Time[3]	0.1 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1 S	1.5 S
1.1.6	Neutral Regen Current	10A (0 disables)	200 A	270 A	350 A	500 A	10 A	100 A
1.1.7	Footbrake Regen Current	10A (0 disables)	200 A	270 A	350 A	500 A	10 A	150 A
1.1.8	Regen Delay	0	300 ms	300 ms	300 ms	300 ms	10 ms	50 ms
1.1.9	Threshold Voltage	0.09 V	3.20 V	3.20 V	3.20 V	3.20 V	0.01 V	0.51 V
1.1.10	Maximum speed	0 %	100 %	100 %	100 %	100 %	1 %	100 %
1.1.11	Rolloff Field	1 % (0 disables)	100 %	100 %	100 %	100 %	1 %	100 %
1.1.12	Cutback speed 1	0 %	100 %	100 %	100 %	100 %	1 %	100 %
1.1.13	Acceleration delay 1	0.1 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1S	0.1 S
1.1.14	Cutback speed 2	0 %	100 %	100 %	100 %	100 %	1 %	100 %
1.1.15	Acceleration delay 2	0.1 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1 S	0.1 S
1.1.16	Cutback speed 3	0 %	100 %	100 %	100 %	100 %	1 %	100 %
1.1.17	Acceleration delay 3	0.1 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1 S	0.1 S
1.1.18	Inch Speed	0 %	25 %	25 %	25 %	25 %	1 %	10 %
1.1.19	Burst Inch Delay	0.1 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1 S	2.0 S
1.1.20	Power Steer Delay	0 S	60 S	60 S	60 S	60 S	1.0 S	5.0 S
1.1.21	Seat Switch Delay	0 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1 S	2.0 S
1.1.22	Accelerator Zero Level	0.00 V	5.00 V[5]	5.00 V[5]	5.00 V[5]	5.00 V[5]	0.02 V[5]	
1.1.23	Accelerator Full Level	0.00 V	5.00 V[5]	5.00 V[5]	5.00 V[5]	5.00 V[5]	0.02 V[5]	
1.1.24	Footbrake Pot Zero Level	0.00 V	5.00 V[5]	5.00 V[5]	5.00 V[5]	5.00 V[5]	0.02 V[5]	
1.1.25	Footbrake Pot Full Level	0.00 V	5.00 V[5]	5.00 V[5]	5.00 V[5]	5.00 V[5]	0.02 V[5]	
1.1.26	Economy Pot Zero Level	0.00 V	5.00 V[5]	5.00 V[5]	5.00 V[5]	5.00 V[5]	0.02 V[5]	
1.1.27	Economy Pot Full Level	0.00 V	5.00 V[5]	5.00 V[5]	5.00 V[5]	5.00 V[5]	0.02 V[5]	
1.1.28	Steer Pot Left Level	0.00 V	5.00 V	5.00 V	5.00 V	5.00 V	0.02 V	
1.1.29	Steer Center	0.00 V	5.00 V	5.00 V	5.00 V	5.00 V	0.02 V	
1.1.30	Steer Pot Right Level	0.00 V	5.00 V	5.00 V	5.00 V	5.00 V	0.02 V	
1.1.31	Dual Motor Inner Angle	5 °	80 °	80 °	80 °	80 °	1.0 °	
1.1.32	Dual Motor Outer Angle	10°	85 °	85 °	85 °	85 °	1.0 °	
1.1.33	Constant Speed	4.0 KPH	6.0 KPH	6.0 KPH	6.0 KPH	6.0 KPH	0.2 KPH	5.6KPH
1.1.34	Belly Delay	0.5 S	5.0 S	5.0 S	5.0 S	5.0 S	0.1 S	1.5 S
1.1.35	Speed Limit	1.0 KPH	51.0 KPH	51.0 KPH	51.0 KPH	51.0 KPH	0.2 KPH	10.0 KPH
1.1.36	Speed Proportional	0 (0 disables)	128	128	128	128	1	20
1.1.37	Brake Proportional	0 (0 disables)	128	128	128	128	1	50
1.1.38	Speed Integral	0 (0 disables)	16	16	16	16	1	1
1.1.39	Brake Integral	0 (0 disables)	16	16	16	16	1	1

1.1.40	Low Voltage Init	14.5 V	36Von 24-36V units, 48Von 24-48V units, 80V on 72-80V units				0.5V	14.5 43V
1.1.41	Low Voltage Cutback	14.5 V	36Von 24-36V units, 48Von 24-48V units, 80V on 72-80V units				0.5V	14.5 43V
1.1.42	Protection Delay	0.1 S	2.5 S	2.5 S	2.5 S	2.5 S	0.1 S	0.5 S
1.1.43	High Voltage Init	14.5 V	50Von 24-36V units, 75Von 24-48V units, 100V on 72-80V units				0.5V	45 70 97.5V
1.1.44	High Voltage Cutback	14.5 V	50Von 24-36V units, 75Von 24-48V units, 100V on 72-80V units				0.5V	47.5 72.5 97.5V

Note 1: Depending on controller type and configuration some of the above may not be displayed.
Note 2: In Speed Control Mode, Deceleration Delay has a maximum of 5.0 S (all units).
Note 3: Direction Regen Current is displayed in Torque mode, and Direction Regen Time is displayed in Speed Control Mode.
Note 4: Pressing the calibrator "down arrow" key from the potentiometer zero and full personalities (1.1.22 to 1.1.29) 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.
Note 5: If this analogue input is configured on pin 10 on the MicropaK unit, the maximum value is 10.00V and the step size is 0.04V.

7.1.2 Traction Controller Status Information

Cal. Ref.	Parameter Displayed	Min.Display	Max.Display	Step size	Log Info.[1]
1.2.1	Battery Voltage	0.0 V	127.5 V	0.5 V	+
1.2.2	Armature Motor Voltage	0.0 V	127.5 V	0.5 V	
1.2.2R	Armature Motor Voltage[2]	0.0 V	127.5 V	0.5 V	
1.2.2L	Armature Motor Voltage[2]	0.0 V	127.5 V	0.5 V	
1.2.3	Field Motor Voltage	0.0 V	127.5 V	0.5 V	
1.2.3R	Field Motor Voltage[2]	0.0 V	127.5 V	0.5 V	
1.2.3L	Field Motor Voltage[2]	0.0 V	127.5 V	0.5 V	
1.2.4	Armature Motor Current	0 A	625 A	5 A	+
1.2.4R	Armature Motor Current[2]	0 A	625 A	5 A	
1.2.4L	Armature Motor Current[2]	0 A	625 A	5 A	
1.2.5	Field Motor Current	0.00 A	32.00A(MP) 64.00A(PP)	0.25A	+
1.2.5R	Field Motor Current[2]	0.00 A	32.00A(MP) 64.00A(PP)	0.25A	
1.2.5L	Field Motor Current[2]	0.00 A	32.00A(MP) 64.00A(PP)	0.25A	
1.2.6	Armature MOSFET Voltage	0 V	127.5 V	0.5 V	
1.2.6R	Armature MOSFET Voltage[2]	0 V	127.5 V	0.5 V	
1.2.6L	Armature MOSFET Voltage[2]	0 V	127.5 V	0.5 V	
1.2.7	Capacitor Voltage	0 V	127.5 V	0.5 V	
1.2.8	Traction Controller Temp.	-30 °C	+225 °C	1 °C	+ -
1.2.8R	Traction Controller Temp[2]	-30 °C	+225 °C	1 °C	
1.2.8L	Traction Controller Temp[2]	-30 °C	+225 °C	1 °C	
1.2.9	Speed estimation (not sensor)	0.0 KPH	25.5 KPH	0.1 KPH	
1.2.9R	Speed estimation (not sensor)[2]	0.0 KPH	25.5 KPH	0.1 KPH	
1.2.9L	Speed estimation (not sensor)[2]	0.0 KPH	25.5 KPH	0.1 KPH	
1.2.10	Key Switch Hours Count	0 Hrs	65279.9 Hrs	0.1 Hrs	
1.2.11	Traction Pulsing Hours Count	0 Hrs	65279.9 Hrs	0.1 Hrs	
1.2.12	Node [Failed3]	Master, Slave, Pump, Low IO or High IO			
-	Service Log Reset	press + followed by - to reset service log			

Note 1: Log Info shows where the + and - keys can be used to access the service max and min data.
Note 2: Status information only applicable for dual traction motor systems
Note 3: In a distributed CANbus system, this item shows which node failed when a CANbus Fault occurs.

7.1.3 Traction Controller 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	0.00 V	5.00 V[3]	0.02 V[3]
1.3.3	Footbrake Pot. %	Range	0 %	100 %	1 %
1.3.4	Footbrake Pot. Voltage	Range	0.00 V	5.00 V[3]	0.02 V[3]
1.3.5	Economy Pot. %	Range	0 %	100 %	1 %
1.3.6	Economy Pot. Voltage	Range	0.00 V	5.00 V[3]	0.02 V[3]
1.3.7	Dual Motor Steer Pot Angle (°C).	Range	-90°C	90°C	1°C
1.3.8	Dual Motor Steer Pot. V	Range	0.00 V	5.00 V	0.02 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	Belly	Switch	Open	Closed	-
1.3.13	Seat	Switch	Open	Closed	-
1.3.14	Tiller	Switch	Open	Closed	-
1.3.15	Brake Over Ride	Switch	Open	Closed	-
1.3.16	Speed Cutback 1	Switch	Open	Closed	-
1.3.17	Speed Cutback 2	Switch	Open	Closed	-
1.3.18	Speed Cutback 3	Switch	Open	Closed	-
1.3.19	Inch Forward	Switch	Open	Closed	-
1.3.20	Inch Reverse	Switch	Open	Closed	-
1.3.21	Handbrake	Switch	Open	Closed	-
1.3.22	Power Steer Trigger Input	Switch	Open	Closed	-
1.3.23	Pump Trigger Input	Switch	Open	Closed	-
1.3.24	Dual Motor Inner Left	Switch	Open	Closed	-
1.3.25	Dual Motor Inner Right	Switch	Open	Closed	-
1.3.26	Dual Motor Outer	Switch	Open	Closed	-
1.3.27	Constant Speed	Switch	Open	Closed	-
1.3.28	Software Version/Revision	Information	000.00	999.99	-
1.3.28A[2]	Data Layer Version/Revision	Information	000.00	999.99	-
1.3.29	Controller Serial Number	Information	00000000	99999999	-
1.3.30	Controller Type	Information	Refer to section 2		

Note 1: As with the personalities, only relevant switch and range tests will be shown determined by configuration.

Note 2: Press down (🡻) from Software Version/Revision (1.3.28) to access this item.

Note 3: If this analogue input is configured on pin 10 on the MicropaK unit, the maximum value is 10.00V and the step size is 0.04V.

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	Reset x.xx V/Cell	2.00 V/Cell	2.50 V/Cell	0.01 V/Cell
1.4.3	Empty x.xx V/Cell	1.50 V/Cell	1.99 V/Cell	0.01 V/Cell
1.4.4	Warning xx %	0 %	90%	1.0 %
1.4.5	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 Traction Controller Setup Menu (Enables/Disables features)

Cal.Ref	Feature	Options
1.6.1	System Setup	**Standalone** / Master / Slave / Dual Traction / Traction + Pump / Dual + Pump
1.6.2	Digital IO	See Note 2

1.6.3	Analogue IP	See Note 2
1.6.4	Contactor Chopping	24 V / **On** / Off
1.6.5	Accelerator Type	Linear / **Curved** / 2* Slope/ Crawl
1.6.6	BDI	On / **Off**
1.6.7	Power Steer Trigger	None to **FS1**+Dir+**Brake**+Seat
1.6.8	Economy Cuts Traction Current	On / **Off**
1.6.9	SRO	On / **Off**
1.6.10	Braking	**Proportional** / Constant
1.6.11	Control Mode	**Torque /** Speed
1.6.12	Tiller Up Forward	On / **Off**
1.6.13	Fault Log	On / **Off**
1.6.14	Service Log	**On** / Off
1.6.15	Vehicle Full Speed	0.0KPH to 51.0KPH
1.6.16	Steer Reverse Enable	**Yes** / No
1.6.17	Roll Off E. Brake	**On**/Off
1.6.18	Battery Volt	**24V** to 96V (2V steps)
1.6.19	Seat & Pump	**On / Off**

Note 1: Changes only take effect after a key-switch recycle

Note 2: See appendix A for Digitial IO and Analogue IP personality configurations.

7.1.7 Motor Setup Menu

Cal. Ref	Parameter Adjusted	Min adjust (all units)	Max. adjust (all units)	Step size (all units)	Typical Default (200A, 270A, 350A, 500A)			
1.7.1	Armature Current low	10A	50% of max	10 A	50 A (all units)			
1.7.2	Field Current low	2.00A	50% of max	0.25A	6.00 A (all units)			
1.7.3	Armature Current mid	Ia Low	Ia High	10 A	100 A	140 A	170 A	250 A
1.7.4	Field Current mid	If Low	If High	1 A	15 A	15 A	25 A	25 A
1.7.5	Armature Current high	50% of max	Maximum	10 A	200 A	270 A	350 A	500 A
1.7.6	Field Current high	50% of max	Maximum	1 A	30 A	30 A	50 A	50 A
1.7.7	Armature Resistance	0 mΩ	255mΩ	1mΩ	30mΩ			
1.7.8	Field Resistance*	0.25Ω	2.50Ω	0.01Ω	0.50Ω			

***Important Note:** **The correct field resistance personality for the SEM motor must be entered at item 1.7.8 for the motor to be controlled correctly.**

Cal. Ref	Feature	Options
1.8.1	Main Hours	Key / Drv / Pmp
1.8.2	Status	Off / Trac I / Trac V / Pump I / Pump V/ KPH / MPH / Accel / Steer / Ver No /
1.8.3	Contrast	1 to 127 (increment steps of 1)
1.8.4	Ind 1	Off / Trac I / Trac V / Pump I / Pump V / KPH / MPH / Accel
1.8.5	Ind 2	Off / Trac I / Trac V / Pump I / Pump V / KPH / MPH / Accel / Steer
1.8.6	Fault Msgs	Off / On

7.2 Adjustment Descriptions

7.2.1 Traction Adjustment Descriptions

Adjustment	Description
Armature Current Limit	Maximum allowable motor Armature current.
Field Current Limit	Maximum allowable motor Field current.
Acceleration Delay	Time taken to ramp up from 0 to 100% on.
Deceleration delay	Time taken to ramp down from 100% to 0% on.
Creep Speed	Minimum applied % on when drive first selected.
Regen Direction Brake Current	Maximum Regen braking current during direction switch change. For Torque mode only.
Regen Direction Brake Time	Time for vehicle to stop during a direction change. For Speed Control mode only.
Regen Neutral Brake Current	Maximum Regen braking current in neutral.
Regen Footbrake Current	Maximum Regen braking current in neutral when F.brake switch active.
Regen Delay	Minimise delay between braking and drive commencing.
Regen Threshold Voltage	Armature voltage at which braking ends and drive commences.
Rolloff Field	Percentage of field current limit applied for plug braking when rolloff is detected.
Maximum Speed	Maximum allowable % on in Torque mode or speed in Speed Control mode.
Cutback Speeds 1, 2 & 3	Maximum allowable % on in Torque mode or speed in Speed Control mode when cutback switches active.
Accel. Delay 1, 2 & 3	Independently adjustable acceleration delays during speed cutbacks.
Inch Speed	Maximum allowable % on during inching operation.
Burst Inch Delay	Timer to allow inching for a set period only.
Power Steer Delay	Delay after power steer trigger removed until contactor opens.
Seat Switch Delay	Delay after seat switch opens until pulsing is inhibited.
Zero Levels	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	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
Steer Center Level	Used to set the mid voltage point when the wheels are at 0 degree's i.e. the vehicle will travel in a straight line.
Dual.Motor Inner Angle	Sets start of inner motor cut band. Typically 45° for non-proportional systems and 10 ° for proportional systems.
Dual.Motor Outer Angle	Sets start of inner motor reverse band. Typically 75° for non-proportional systems and 50° for proportional systems.
Constant Speed	Drive at set speed when the Constant Speed input is configured and active. Only operates for controllers setup as speed controlled walkies.
Belly Delay	Time belly operation, drive in forward, remains active, irrespective of how long belly switch is closed. Only operates for controllers setup as a walkie
Speed Limit	Maximum speed when the controller is setup in speed control mode.
Speed Proportional	Proportional gain for traction speed control.
Brake Proportional	Proportional gain for braking speed control.
Speed Integral	Integral gain for traction speed control.
Brake Integral	Integral gain for braking speed control.
Low Voltage Init	Voltage at which controllers starts reducing the max available current limit to help reduce voltage drops
Low Voltage Cutback	Voltage at which current limit is reduced to 0
Protection Delay	Length of time the voltage can fall below the Low Voltage Cutback level for, before a fault is indicated. This helps prevent low voltage spikes tripping a low battery fault
High Voltage Init	Voltage at which controller reduces Regen braking to help prevent high generated voltages damaging the battery or controller.
High Voltage Cutback	Voltage at which contactors will open, to prevent high voltage damage.

7.2.2 BDI adjustment descriptions

BDI Adjustment	Description
Charge remaining	Displays remaining battery charge. Display only, no adjustments can be made.
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 cut-out action, Pump cut-out and Traction speed 2 limit initiated.

7.2.3 Setup Menu Descriptions

Setup menu Option	Description
System Set Up	**Standalone/Master/Slave/Dual Traction/Traction + Pump/ Dual + Pump** – Set to **Standalone** for single traction motor operation, **Master** for single traction motor operation when there is a CANbus Display in the system (NOTE: CANbus displays do not include Standard and Full Feature Displays), **Slave** for all other system units not designated the Master , **Dual** for dual motor applications, **Track + Pump** for single traction and pump controller applications and **Dual + Pump** for dual traction and single pump applications.
Digital IO	See Appendix A
Analogue IP	See Appendix A
Contactor Chopping	**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	**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 1.
BDI	**On/Off - On** enables the BDI (Battery Discharge Indicator) and any warning/cut-out settings, **Off** disables the BDI feature and removes the BDI setup menu display.
Power Steer Trigger	**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** – 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 close., whilst setting to F+D+B will trigger the delay when either FS1 or Direction or the Brake switches are closed.
Economy cuts traction current	**On/Off** - set to **On** for current limit to be reduced during economy or **Off** for just the standard acceleration delay increase.
SRO	**On/Off - On** = SRO enabled, **Off** = SRO disabled
Braking	**Prop/Const - Prop** = Direction braking level is proportional to accelerator position, **Const** = Direction braking is constant level.
Control Mode	**Torque / Speed - Torque** = Accel. demand acts as a torque demand, **Speed** = Accel. Demand acts as a speed demand.
Tiller Up Forward	**On/Off - On**=Vehicle can drive in the forward direction with the tiller up**, Off** = Normal tiller operation.
Digital Input Configuring.	**Speed 1/Speed 2/Inch Fwd/Inch Rev/Handbrake/Pst.Trig/Inner/Outer -** Skt B pins 6 & 7 can be configured to perform the above input functions.
Analog Input Configuring	**Accel/Footbrake/Economy/Digital** Skt B pins 10 & 11 analog inputs can be configured to perform the above input functions. One analog input can be used as a digital.
Contactor Output 2 configuring.	**Pump / P.Steer / Brake / Remote LED** Skt B pin 9 can be configured to perform the above Contactor output functions.
Fault Log	**On/Off - On** = Fault Log enabled, **Off** = Disabled and no display.
Service Log	**On/Off - On** = Service Log enabled, **Off** = Disabled and no display.
Full Speed	Maximum unladen vehicle speed. Reported speed will be proportional to this value. A reading of maximum unladen vehicle speed should be taken in torque mode via an independent means and the value entered.
Steer Reverse	**Yes / No** – **Yes** when inner motor reversal in turns is required (e.g. 3 Wheel Trucks). Set to **No** when no inner motor reversal in turns is not required (e.g. 4 Wheel Trucks).
Roll Off E. Brake	**On/Off. On** = Anti rolloff condition activates electric brake immediately. **Off** = rolloff operates as normal. . Only operates for controllers setup as walkies with electric brake.

Battery Voltage	**24V to 96V. T**he nominal battery voltage
Seat & Pump	**On/Off. On = if the pump contactor is already closed, open the pump contactor when the seat switch has been open for the Seat Delay personality. Off = if the pump contactor is already closed, leave the pump contactor closed regardless of the seat condition until the pump demand is removed.**

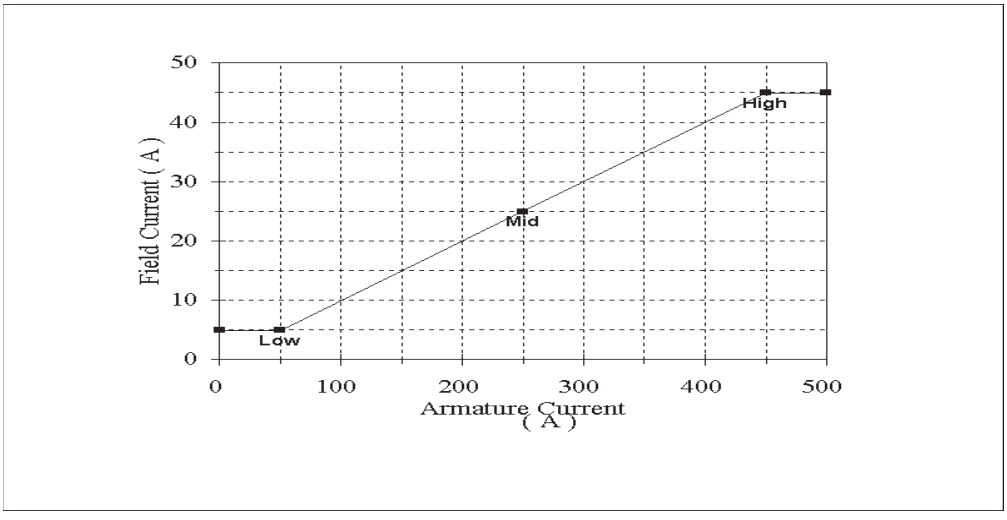
7.2.4 Motor Setup Menu

Parameter Adjusted	Description
Armature Current low	Sets the range of Armature current, 0 to Ia(low), in which the Field Current low limit operates.
Field Current low	Sets the target Field current when Armature current is less than Ia(low). This value will affect the maximum speed of the unladen vehicle.
Armature Current mid	Intermediate value of Armature current, Ia(mid).
Field Current mid	Sets the intermediate Field current for the above Armature mid point.
Armature Current high	Sets the range of Armature current, Ia(high) to I(max), in which the Field Current high limit operates.
Field Current high	Sets the target Field current when the Armature current is more than Ia(high).
Armature Resistance	Armature resistance of the motor, in milli-Ohms, at 25°C
Field Resistance	Field resistance, in Ohms, at 25°C. This value **MUST** be entered for the motor to be controlled correctly. If the field resistance exceeds 1.60Ω, please contact Sevcon for further advice.

The motor setup menu allows the Armature current to Field current mapping graph (shown below) to be modified. The 6 settings above essentially define 3 points low, mid and high, which are interconnected by straight lines, which make up the mapping graph. The controller software uses the graph by measuring the Armature current, feeding it through the graph to obtain a target Field current.

This graph allows the controller to optimally control the motor, by setting a minimum Field current at low and high armature currents, as well as proving a mid range point to help tune the mid speed range /power ratio, useful when optimising the speed of gradient climbing versus motor heating.

7.2.4.1 Armature/Field Mapping Graph.



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...
OK (lowest priority)			on	Traction operational and OK.	No action required.
BDI Cutout	BDI Cut	BDI CUT OUT	7F	BDI enabled and cut-out action initiated.	Battery charged.
Thermal Cutback	Over Temp.	TRAC HOT	8F	Traction heatsink above 75°C. Allow controller to cool.	Heatsinking, Mounting, Surfaces clean, fan req.
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.
Steer Pot Fault	Steer Fault	STEER FAULT	6F	Wire off steer pot input.	Steer pot wiring
Belly Fault	Belly Fault	BELLY FAULT	2F	Belly Switch is active.	Check Belly Switch is open and check Belly Switch wiring.
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.
2 Dir. Fault	2 Dir Fault	2 DIR FAULT	2F	Two directions selected together. Recycle both Directions and FS1.	Direction switch wiring.
SRO Fault	SRO Fault	SRO FAULT	2F	Dir. switch selected > 2 seconds after FS1. Recycle FS1 and Dir.	Dir first then FS1, FS1 and Dir. switch wiring.
Seat Fault	Seat Fault	SEAT FAULT	2F	Drive selected and no seat sw. Recycle Dir and FS1 switch	Seat switch, closed, seat wiring.
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.
Steer Fault	Steer Fault	STEER FAULT	2F	Outer switch closing before inner.	Switch operation/wiring.
Battery Low	Bat. Low	BATTERY LOW	7F	Battery < Low battery personality. Recycle FS1 or Direction switch	Correct battery voltage, Discharged battery.
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.
Pers Error	Pers Error	PERS ERROR	1F	Personalities out of range at power up.	Reset personalities out of range (shown as ----.-).
CRC error	CRC Error	CRC ERROR	1F	One or more personalities have been corrupted.	Check **all** personalities then recycle keyswitch.
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.
Mosfet s/c	FET s/c	MOSFET FAIL	3F	MOSFET s/c Recycle FS1 or Direction	A / F1 / F2 / B- power wiring, MOSFETs s/c.
Line Cont O/C	Fail	FAIL	4F	Line Contactor did not close.	Check Line Contactor coil wiring
PUp Trac Weld	Fail	FAIL	4F	Line Contactor welded shut	Check Line Contactor
PUp Trac MOS	Fail	FAIL	3F	MOSFET s/c Recycle FS1 or Direction	A / F1 / F2 / B- power wiring, MOSFETs s/c.
EEPROM Fault	Fail	FAIL	1F	Internal Memory fault	Contact Sevcon
CANbus Fault	CAN Fault	FAIL	12F	Node on CANbus not communicating	Check CANbus wiring
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 Armature Current
- Maximum Motor Field Current
- Maximum Controller Temperature and Minimum Controller Temperature.

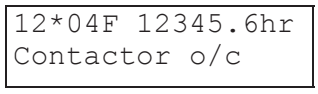
To clear the log, access the "Service Log + to reset log" message at the end of the Status menu, and follow the prompts. The service log can be enabled and disabled in the Setup menu.

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/Motor 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	Not 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)
- 12 flash faults	Not Logged	(CAN bus 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:



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.