TECHNICAL DATA

Fluke eMobility Tools Kit with FEV100 Test Adapter, 125B ScopeMeter®, 87V Multimeter and Test Leads

Key features

- Test charging states of EVSE with CP state simulation with the 12B ScopeMeter®.
- Verify charging voltage and maximum available current using the 87V multimeter and TL224 test leads.
- Check protective earth for correct wiring and functioning with the PE pre-test feature.
- Perform GFCI troubleshooting of EVSE and verify operation within safety standards.

Product overview: Fluke eMobility Tools Kit with FEV100 Test Adapter, 125B ScopeMeter®, 87V Multimeter and Test Leads

Test the safety and performance of a type 1, level 1 or level 2 electric vehicle ac charging stations (EVSEs) with the Fluke FEV100, 87V + 125B ScopeMeter® kit. This kit includes the FEV100 test adapter to simulates the presence of an electrical vehicle. When connected to the test adapter, the 87V multimeter will allow you to monitor the output voltage and maximum charging current of the station. Verify EVSE charging states (vehicle simulation) by connecting the 125B ScopeMeter® to measure the control pilot signal output. With this kit, it's easy to verify an EV charging station is working properly after install and during periodic maintenance, or troubleshoot an EVSE if it is not delivering the appropriate charge. SAE J1772 compliant to North American standards.

EVSE installation safety and performance checks

- PE PRE-TEST: Grounding system pre-test verifies that there is no presence of dangerous voltage at the ground terminal.
- GFCI TEST: Ground fault circuit interrupter test verifies the breaker of the EVSE is connected by detecting ground faults.

- PE ERROR: Ground fault simulation indicates an interruption of the ground conductor; the pending charging process is aborted, and new charging processes are prevented.
- CP ERROR “E”: The standard J1772 defines Error “E” as a state when charging station is disconnected from vehicle, disconnected from utility, there is a loss of utility power or control pilot is short to control pilot reference (ground).

Specifications: Fluke eMobility Tools Kit with FEV100 Test Adapter, 125B ScopeMeter®, 87V Multimeter and Test Leads

Fluke FEV100 Electric Vehicle Charging Station Test Adapter specifications	
Input voltage	UL1/N = 120 V, UL2/N = 120 V, UL1/L2 = 208 V, 60 Hz (three-phase system) or UL1/N = 120 V, UL2/N = 120 V, UL1/L2 = 240 V, 60 Hz (single-phase system), ±10% voltage fluctuations from nominal
EV connector (EVC-13)	SAE J1772 socket, 16 A (type 1, 5P single-phase)
Internal power consumption	2 W max.
Operating temperature	-4 °F to 104 °F (-20 °C to 40 °C)
Storage temperature	-4 °F to 122 °F (-20 °C to 50 °C)
Operating humidity range	10 % to 85 % relative humidity non-condensing
Storage relative humidity	0 % to 85 % non-condensing
Operating altitude	6561 ft (2000 m) max.
Dimensions (H × W × D)	Approx. 8.66 x 4.33 x 1.77 in (220 x 110 × 45 mm) without cable assembly
Weight	Approx. 4.4 lb (2 kg)

Safety standards	IEC 61010-1, Pollution Degree 2 IEC 61010-2-030
Measurement category	CAT II 250 V
IP protection class	IP54
Electromagnetic Compatibility (EMC)	
International	IEC 61326-1: Basic Electromagnetic Environment CISPR 11: Group 1, Class A Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself. Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances. Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.
USA (FCC)	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.
Functions	
CP States	A, B, C, D
CP Error "E"	On/off
PE Error	On/off
GFCI Test	Yes, test resistor of 2 kΩ connected between L1 and PE, time limitation 40 ms
PE Pre-Test (typical)	Visible indication >30 V on PE conductor
Outputs (for test purpose only)	
Measuring terminals L1, L2/N, PE	Max. 250 V 50/60 Hz, CAT II 250 V
CP signal output terminals	Approx. ±12 V (under normal conditions), in case of wrong wiring or error of the charging station these terminals can be hazardous ≥ max. 250 V against PE

Fluke 120B Series Industrial ScopeMeter® Hand-Held Oscilloscopes Specification: Oscilloscope mode		
Vertical		
Frequency response - dc coupled	Without probes and test leads (with BB120)	123B: dc to 20 MHz (-3 dB) 124B and 125B: dc to 40 MHz (-3 dB)
	With STL120-IV 1:1 shielded test leads	DC to 12.5 MHz (-3 dB) / dc to 20 MHz (-6 dB)
	With VP41 10:1 Probe	123B: dc to 20MHz (-3 dB) 124B and 125B: dc to 40 MHz (-3 dB)

Frequency response - ac coupled (If roll off)	Without probes and test leads	<10 Hz (-3 dB)
	With STL120-IV 1:1 shielded test leads	<10 Hz (-3 dB)
	With VP41 10:1 Probe	<10 Hz (-3 dB)
Rise time, excluding probes, test leads	123B <17.5 ns 124B and 125B <8.75 ns	
Input impedance	Without probes and test leads	1 MΩ//20 pF
	With BB120	1 MΩ//24 pF
	With STL120-IV 1:1 shielded test leads	1 MΩ//230 pF
	With VP41 10:1 Probe	5 MΩ//15.5 pF
Sensitivity	5 mV to 200 V/div	
Analog bandwidth limiter	10 kHz	
Display modes	A, -A, B, -B	
Max. input voltage A and B	Direct, with test leads, or with VP41 Probe	600 Vrms Cat IV, 750 Vrms maximum voltage.
	With BB120	600 Vrms
Max. floating voltage, from any terminal to ground	600 Vrms Cat IV, 750 Vrms up to 400Hz	
Horizontal		
Scope modes	Normal, Single, Roll	
Ranges (normal)	Equivalent sampling	123B: 20 ns to 500 ns/div,
		124B and 125B: 10 ns to 500 ns/div
	Real time sampling	1 µs to 5 s/div
	Single (real time)	1 µs to 5 s/div
	Roll (real time)	1s to 60 s/div
Sampling rate (for both channels simultaneously)	Equivalent sampling (repetitive signals)	Up to 4 GS/s
	Real time sampling 1 µs to 60 s/div	40 MS/s

Trigger		
Screen update	Free run, on trigger	
Source	A, B	
Sensitivity A and B	@ DC to 5 MHz	0.5 divisions or 5 mV
	@ 40 MHz	123B: 4 divisions
		124B and 125B: 1.5 divisions
	@ 60 MHz	123B: N/A
		124B and 125B: 4 divisions
Slope	Positive, negative	

Advanced scope functions		
Display modes	Normal	Captures up to 25 ns glitches and displays analog-like persistence waveform
	Smooth	Suppresses noise from a waveform
	Glitch off	Does not capture glitches between samples
	Envelope	Records and displays the minimum and maximum of waveforms over time
Auto set (Connect-and-View™)	Continuous fully automatic adjustments of amplitude, time base, trigger levels, trigger gap, and hold-off. Manual override by user adjustment of amplitude, time base, or trigger level.	

Dual input meter
The accuracy of all measurements is within ±(% of reading + number of counts) from 18 °C to 28 °C.
Add 0.1x (specific accuracy) for each °C below 18 °C or above 28 °C. For voltage measurements with 10:1 probe, add probe uncertainty +1%. More than one waveform period must be visible on the screen.

Input A and input B		
DC voltage (VDC)		
Ranges	500 mV, 5 V, 50 V, 500 V, 750 V	
Accuracy	±(0.5% +5 counts)	
Common mode rejection (CMRR)	>100 dB @ dc, >60 dB @ 50, 60, or 400 Hz	
Full scale reading	5000 counts	
True-rms voltages (V ac and V ac+dc)		
Ranges	500 mV, 5 V, 50 V, 500 V, 750 V	
Accuracy for 5% to 100% of range (DC coupled)	DC to 60 Hz (V ac+dc)	±(1% +10 counts)
	1 Hz to 60 Hz (V ac)	±(1% +10 counts)
Accuracy for 5% to 100% of range (AC or dc coupled)	60 Hz to 20 kHz	±(2.5% +15 counts)
DC rejection (only VAC)	>50 dB	
Common mode rejection (CMRR)	>100 dB @ dc	
	>60 dB @ 50, 60, or 400 Hz	
Full scale reading	5000 counts, reading is independent of any signal crest factor.	
Peak		
Modes	Max peak, Min peak, or pk-to-pk	
Ranges	500 mV, 5 V, 50 V, 500 V, 2200 V	
Accuracy	Accuracy Max peak or Min peak	5% of full scale
	Accuracy Peak-to-Peak	10% of full scale

Full scale reading	500 counts	
Frequency (Hz)		
Ranges	123B: 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz,1 MHz, 10 MHz, and 50 MHz	
	124B and 125B: 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz, 10 MHz, and 70 MHz	
Frequency range	15 Hz (1 Hz) to 50 MHz in continuous autoset	
Accuracy @1 Hz to 1 MHz	±(0.5% +2 counts)	
Full scale reading	10,000 counts	
RPM		
Max reading	50.00 kRPM	
Accuracy	±(0.5% +2 counts)	
Duty cycle (PULSE)		
Range	2% to 98%	
Frequency range	15 Hz (1 Hz) to 30 MHz in continuous autoset	
Pulse width (PULSE)		
Frequency range	15 Hz (1 Hz) to 30 MHz in continuous autoset	
Full scale reading	1000 counts	
Amperes (AMP)		
With current clamp	Ranges	Same as V dc, V ac, V ac+dc, or PEAK
	Scale factors	0.1 mV/A, 1 mV/A, 10 mV/A, 100 mV/A, 400 mV/A, 1 V/A, 10 mV/mA
	Accuracy	Same as V dc, V ac, V ac+dc, or PEAK (add current clamp uncertainty)
Temperature (TEMP) with optional temperature probe		
Range	200 °C/div (200 °F/div)	
Scale factor	1 mV/°C and 1 mV/°F	
Accuracy	As V dc (add temp. probe uncertainty)	
Decibel (dB)		
0 dBV	1 V	
0 dBm (600 Ω /50 Ω)	1 mW referenced to 600 Ω or 50 Ω	
dB on	V dc, V ac, or Vac+dc	
Full scale reading	1000 counts	
Crest factor (CREST)		
Range	1 to 10	
Full scale reading	90 Counts	
Phase		
Modes	A to B, B to A	

Range	0 to 359 degrees	
Resolution	1 degree	
Power (125B only)		
Configurations	1 phase / 3 phase 3 conductor balanced loads (3 phase: fundamental component only, AUTOSET mode only)	
Power factor (PF)	Ratio between watts and VA range - 0.00 to 1.00	
Watt	RMS reading of multiplying corresponding samples of input A (volts) and input B (amperes)	
	Full scale reading	999 counts
VA	Vrms x Arms	
	Full scale reading	999 counts
VA reactive (var)	$\sqrt{((VA)^2-W^2)}$	
	Full scale reading	999 counts
Vpwm		
Purpose	To measure on pulse width modulated signals, like motor drive inverter outputs	
Principle	Readings show the effective voltage based on the average value of samples over a whole number of periods of the fundamental frequency	
Accuracy	As Vrms for sinewave signals	

Input A to common		
Ohm (Ω)		
Ranges	123B and 124B	500 Ω , 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 30 MΩ
	125B	50 Ω, 500 Ω , 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 30 MΩ
Accuracy	±(0.6% + 5 counts) 50 Ω ±(2% + 20 counts)	
Full scale reading	50 Ω to 5 MΩ - 5000 counts, 30 MΩ - 3000 counts	
Measurement current	0.5 mA to 50 nA, decreases with increasing ranges	
Open circuit voltage	<4 V	
Continuity (Cont)		
Beep	<(30 Ω ±5 Ω) in 50 Ω range	
Measurement current	0.5 mA	
Detection of shorts of	≥1 ms	
Diode		
Measurement voltage	@0.5 mA	>2.8 V
	@open circuit	<4 V
Measurement current	0.5 mA	
Polarity	+ on input A, - on COM	

Capacitance (CAP)	
Ranges	50 nF, 500 nF, 5 µF, 50 µF, 500 µF
Full scale reading	5000 counts
Measurement current	500 nA to 0.5 mA, increases with increasing ranges

Advanced meter functions	
Zero Set	Set actual value to reference
AutoHold (on A)	Captures and freezes a stable measurement result. Beeps when stable. AutoHold works on the main meter reading, with thresholds of 1 Vpp for AC signals and 100 mV for DC signals.
Fixed decimal point	Activated by using attenuation keys

Cursor Readout (124B and 125B)	
Sources	A, B
Single vertical line	Average, min and max readout
	Average, min, max and time from start of readout (in ROLL mode; instrument in HOLD)
	Min, max and time from start of readout (in RECORDER mode; instrument in HOLD)
	Harmonics values in POWER QUALITY mode.
Dual vertical lines	Peak-peak, time distance and reciprocal time distance readout
	Average, min, max and time distance readout (in ROLL mode; instrument in HOLD)
Dual horizontal lines	High, low and peak-peak readout
Rise or fall time	Transition time, 0%-level and 100%-level readout (manual or auto leveling; auto leveling only possible in single channel mode)
Accuracy	As oscilloscope accuracy

Recorder
The recorder captures meter readings in Meter Recorder mode or continuously captures waveform samples in Scope Recorder mode. The information is stored on internal memory or on optional SD card (with the 125B or 124B).
The results are displayed as Chart recorder display that plots a graph of min and max values of Meter measurements over time or as a waveform recorder display that plots all the captured samples.

Meter readings	
Measurement Speed	Maximum 2 measurement/s
Record Size (min, max, average)	2 M readings for 1 channel
Recorded Time Span	2 weeks
Maximum number of events	1024
Waveform record	

Maximum sample rate	400 K sample/s
Size Internal memory	400 M samples Recorded Time
Span internal memory	15 minutes at 500 µs/div 11 hours at 20 ms/div
Record Size SD card	1.5 G samples
Recorded Time Span SD card	11 hours at 500 µs/div 14 days at 20 ms/div
Maximum number of events	64

Power Quality (125B only)		
Readings	Watt, VA, var, PF, DPF, Hz	
Watt, VA, var ranges (auto)	250 W to 250 MW, 625 MW, 1.56 GW	
	When selected: total (% r)	±(2% + 6 counts)
	When selected: fundamental (% f)	±(4% + 4 counts)
DPF	0.00 to 1.00	
PF	0.00 to 1.00, ±0.04	
Frequency range	10.0 Hz to 15.0 kHz 40.0 Hz to 70.0 Hz	
Number of Harmonics	DC to 51	
Readings / Cursor readings (fundamental 40 Hz to 70 Hz)	Vrms / Arms /Watt	Each harmonic from fundamental maybe selected for individual readings
Includes frequency of fundamental, phase Angle and K-factor (in Amp and Watt)		

BusHealth tester (Fluke 125B only)		
Type	Subtype	Protocol
AS-i	NEN-EN50295	
CAN	ISO-11898	
Interbus S	RS-422	EIA-422
Modbus	RS-232	RS-232/EIA-232
	RS-485	RS-485/EIA-485
Foundation Fieldbus	H1	61158 type 1, 31.25 kBit
Profibus	DP	EIA-485
	PA	61158 type 1

Miscellaneous		
Display	Type	5.7-inch color active matrix TFT
	Resolution	640 x 480 pixels

Waveform Display	Vertical	10 div of 40 pixels
	Horizontal	12 div of 40 pixels
Power	External	Via Power Adapter BC430
	Input voltage	10 V DC to 21 V DC
	Power consumption	5 W typical
	Input connector	5 mm jack
	Internal	Via Battery Pack BP290
	Battery power	Rechargeable Li-Ion 10.8 V
	Operating time	7 hours with 50% backlight brightness
	Charging time	4 hours with test tool off, 7 hours with test tool on
	Allowable ambient temp	0 to 40 °C (32 to 104 °F) during charging
Memory	Internal memory can store 20 data sets (screen waveform and setup)	Micro SD card slot with optional SD card (max size of 32 GB)
Mechanical	Size	259 x 132 x 55 mm (10.2 x 5.2 x 2.15 in)
	Weight	1.4 kg (3.2 lb) including battery pack
Interface	Optically isolated	Transfer screen copies (bitmaps), settings and data
	USB to PC/laptop	OC4USB optically isolated USB adapter/cable, (optional), using FlukeView® software for Windows®.
	Optional WiFi adapter	Fast transfer of screen copies (bitmaps), settings and data to PC/laptop, tablet, smartphone, etc. A USB port is provided for attaching the WiFi dongle. Do not use the USB port with a cable for safety reasons.
Environmental		
Environmental	MIL-PRF-28800F, Class 2	
Temperature	Battery Operation	0 to 40 °C (32 to 104 °F)
	Power Adapter Operation	0 to 50 °C (32 to 122 °F)
	Storage	-20 to 60 °C (-4 to 140 °F)
Humidity (Operating)	@ 0 to 10 °C (32 to 50 °F)	Non-condensing
	@ 10 to 30 °C (50 to 86 °F)	95%
	@ 30 to 40 °C (86 to 104 °F)	75%
	@ 40 to 50 °C (104 to 122 °F)	45%
Storage	@ -20 to 60 °C (-4 to 140 °F)	Non-condensing

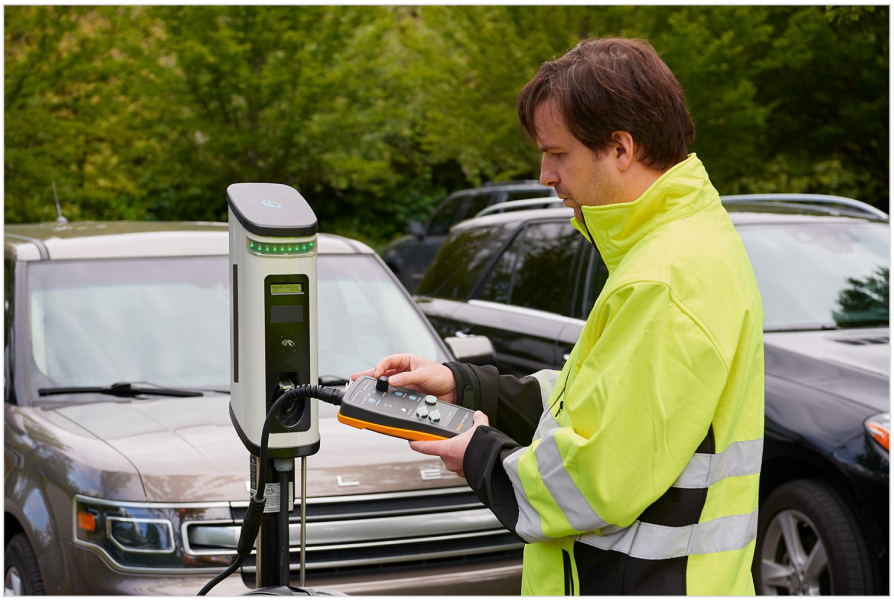
Altitude	Operating at 3 km (10,000 feet)	CAT III 600 V
	Operating at 2 km (6,600 feet)	CAT IV 600 V
	Storage	12 km (40,000 feet)
EMC electromagnetic compatibility	International	IEC 61326-1: Industrial, CISPR 11: Group 1, Class A
	Korea (KCC)	Class A Equipment (Industrial Broadcasting & Communication Equipment)
	USA (FCC)	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.
Wireless radio with adapter	Frequency range	2412 MHz to 2462 MHz
	Output power	<100 mW
Enclosure protection	IP51, ref: EN/IEC60529	
Safety	General	IEC 61010-1: Pollution Degree 2
	Measurement	IEC 61010-2-033: CAT IV 600 V/CAT III 750 V
Max. input voltage input A and B	Direct on input or with leads	600 Vrms CAT IV for derating
	With Banana-to-BNC Adapter BB120	600 Vrms for derating
	Max. floating voltage from any terminal to ground	600 Vrms Cat IV, 750 Vrms up to 400 Hz

Fluke 87V Industrial Multimeter Specifications		
Voltage DC	**Maximum voltage**	1000 V
	Accuracy	±(0.05% + 1)
	Maximum resolution	10 µV
Voltage AC	**Maximum voltage**	1000 V
	Accuracy	±(0.7% + 2) True RMS
	AC bandwidth	20 kHz with low pass filter; 3 dB @ 1 kHz
	Maximum resolution	0.1 mV
Current DC	**Maximum amps**	10 A (20 A for 30 seconds maximum)
	Amps accuracy	±(0.2% + 2)
	Maximum resolution	0.01 µA
Current AC	**Maximum amps**	10 A (20 A for 30 seconds maximum)
	Amps accuracy	±(1.0% + 2) True RMS
	Maximum resolution	0.1 µA
Resistance	**Maximum resistance**	50 MΩ
	Accuracy	±(0.2% + 1)
	Maximum resolution	0.1 Ω

Capacitance	**Maximum capacitance**	9,999 µF
	accuracy	±(1% + 2)
	Maximum resolution	0.01 nF
Frequency	**Maximum frequency**	200 kHz
	Accuracy	±(0.005% + 1)
	Maximum resolution	0.01 Hz
Duty cycle	**Maximum duty cycle**	99.9%
	Accuracy	±(0.2% per kHz + 0.1%)
	Maximum resolution	0.1%
Temperature measurement	−200.0 °C – 1090 °C −328.0 °F – 1994.0 °F excluding probe	
80 BK temperature probe	−40.0 °C – 260 °C −40.0 °F – 500 °F, 2.2 °C or 2% whichever is greater	
Conductance	**Maximum conductance**	60.00 nS
	Accuracy	±(1.0% + 10)
	Maximum resolution	0.01 nS
Diode	**Range**	3 V
	Resolution	1 mV
	Accuracy	±(2% + 1)
Duty cycle range	**Accuracy**	Within ±(0.2% per kHz + 0.1%)
Environmental Specifications		
Operating temperature	−20 °C to + 55 °C	
Storage temperature	−40 °C to + 60 °C	
Humidity (without condensation)	0% – 90% (0 °C – 35 °C) 0% – 70% (35 °C – 55 °C)	
Operating Altitude	2000 m	
Safety Specifications		
Overvoltage category	EN 61010–1 to 1000 V CAT III, 600V CAT IV	
Agency approvals	CE, CSA, RCM	
Mechanical and General Specifications		
Size	201 x 98 x 52 mm (with holster)	
Weight	355 g 624 g – with holster	
Display	**Digital**	6000 counts updates 4/sec. 19,999 counts in high–resolution mode
	Analog	32 segments, updates 40/sec
	Frequency	19,999 counts, updates 3/sec at > 10 Hz

Warranty	Lifetime	
Battery Life	**Alkaline**	~400 hours typical, without backlight
Shock	1 Meter drop per IEC 61010–1:2001	
Vibration	Per MIL–PRF–28800 for a Class 2 instrument	

Ordering information



FLK-FEV100/TY1 KIT2

Includes:

FEV100
- Fluke FEV100/BASIC Test Adapter
- Fluke FEV-CON/TY1 Type 1 Connector & Cable
- Soft Carrying Case
- User Manual
- 3-year warranty

125B
- Fluke 125B Hand-Held Oscilloscope
- Shielded Test Leads with Black Ground Leads
- Test Lead Black (for Grounding)
- Hook Clips (red, blue)
- Banana-to-BNC Adapters (black, x1)
- 10:1 Voltage Probe
- i400s AC Current Clamp
- USB Angled Adapter
- WiFi USB Adapter
- Switch Mode Power Supply, Adapter/Battery Charger
- Rechargeable Li-ion Battery Pack

87V
- Fluke 87V Industrial Multimeter
- TL75 Test Leads (TL175 Eur)
- AC175 Alligator Clips
- Holster with tilt-leg, test lead storage
- 80BK Temperature Probe
- 9V Battery (Installed)

TL224
- One pair (red, black) silicone insulated leads with one straight female coupler on one end and right angled on the other