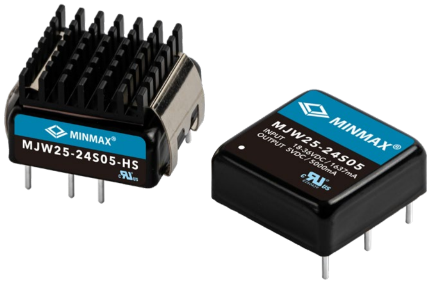
FEATURES

- **Smallest Encapsulated 25W Converter**
- **Ultra-compact 1" X 1" Package**
- **Wide 2:1 Input Voltage Range**
- **Fully Regulated Output Voltage**
- **Excellent Efficiency up to 90%**
- **I/O Isolation 1500 VDC**
- **Operating Ambient Temp. Range -40℃ to +80℃**
- **No Min. Load Requirement**
- **Overload/Voltage and Short Circuit Protection**
- **Remote On/Off Control, Output Voltage Trim**
- **Shielded Metal Case with Insulated Baseplate**
- **UL/cUL/IEC/EN 62368-1(60950-1) Safety Approval & CE Marking**



UL 62368-1
CSA 60950-1
CB Scheme

PRODUCT OVERVIEW

The MINMAX MJW25 series is the generation of high-performance DC-DC converter modules with very high power density.
The product offers fully 25W in a shielded metal package with dimensions of just 1.0"x1.0"x0.4". All models provide wide 2:1 input range and tightly regulated output voltage. By state-of-the-art circuit topology a very high efficiency up to 90% could be achieved allowing an operating temperature range of -40℃ to +80℃ (with derating).
These converters are qualified for demanding applications in battery operated equipment, instrumentation, data communication, industrial and many other space critical applications.

Model Selection Guide

Model Number	Input Voltage (Range)	Output Voltage	Output Current	Input Current		Reflected Ripple Current	Over Voltage Protection	Max. capacitive Load	Efficiency (typ.)
			Max.	@Max. Load	@No Load				@Max. Load
	VDC	VDC	mA	mA(typ.)	mA(typ.)	mA (typ.)	VDC	µF	%
MJW25-12S033	12 (9 ~ 18)	3.3	6000	1900	75	80	3.9	10300	87
MJW25-12S05		5	5000	2340	85		6.2	6800	89
MJW25-12S12		12	2090	2350	80		15	1200	89
MJW25-12S15		15	1670	2350	80		18	750	89
MJW25-12D12		±12	±1040	2340	75		±15	680#	89
MJW25-12D15		±15	±840	2360	75		±18	380#	89
MJW25-24S033	24 (18 ~ 36)	3.3	6000	940	55	50	3.9	10300	88
MJW25-24S05		5	5000	1160	60		6.2	6800	90
MJW25-24S12		12	2090	1160	55		15	1200	90
MJW25-24S15		15	1670	1160	55		18	750	90
MJW25-24D12		±12	±1040	1170	50		±15	680#	89
MJW25-24D15		±15	±840	1180	50		±18	380#	89
MJW25-48S033	48 (36 ~ 75)	3.3	6000	470	35	30	3.9	10300	88
MJW25-48S05		5	5000	580	40		6.2	6800	90
MJW25-48S12		12	2090	580	35		15	1200	90
MJW25-48S15		15	1670	580	35		18	750	90
MJW25-48D12		±12	±1040	585	40		±15	680#	89
MJW25-48D15		±15	±840	590	40		±18	380#	89

For each output

Input Specifications

Parameter		Conditions / Model	Min.	Typ.	Max.	Unit
Input Surge Voltage (100ms max.)		12V Input Models	-0.7	---	25	VDC
		24V Input Models	-0.7	---	50	
		48V Input Models	-0.7	---	100	
Start-up Threshold Voltage		12V Input Models	---	---	9	
		24V Input Models	---	---	18	
		48V Input Models	---	---	36	
Input Polarity Protection		None				
Start-up Time	Power Up	Nominal Vin and Constant Resistive Load	---	---	30	ms
	Remote On/Off		---	---	30	ms
Input Filter		All Models	Internal LC Type			

Remote On/Off Control

Parameter	Conditions	Min.	Typ.	Max.	Unit
Converter On	3.5V ~ 12V or Open Circuit				
Converter Off	0V ~ 1.2V or Short Circuit				
Control Input Current (on)	Vctrl = 5.0V	---	---	0.5	mA
Control Input Current (off)	Vctrl = 0V	---	---	-0.5	mA
Control Common	Referenced to Negative Input				
Standby Input Current	Nominal Vin	---	3	---	mA

Output Specifications

Parameter	Conditions / Model		Min.	Typ.	Max.	Unit
Output Voltage Setting Accuracy			---	---	±1.0	%Vnom.
Output Voltage Balance	Dual Output, Balanced Loads		---	---	±2.0	%
Line Regulation	Vin=Min. to Max. @Full Load		---	---	±0.2	%
Load Regulation	Io=0% to 100%	Single Output	---	---	±0.2	%
		Dual Output	---	---	±1.0	%
Cross Regulation (Dual)	Asymmetrical load 25% / 100% FL		---	---	±5.0	%
Minimum Load	No minimum Load Requirement					
Ripple & Noise	0-20 MHz Bandwidth	3.3V & 5V Models(3)	---	---	100	mV P-P
		12V , 15V & Dual Models(3)	---	---	150	mV P-P
Transient Recovery Time	25% Load Step Change(2)		---	250	---	μsec
Transient Response Deviation			---	±3	±5	%
Temperature Coefficient			---	---	±0.02	%/℃
Trim Up / Down Range (See Page 6)	% of Nominal Output Voltage		---	---	±10	%
Over Load Protection	Current Limitation at 150% typ. of Iout max., Hiccup					
Short Circuit Protection	Continuous, Automatic Recovery (Hiccup Mode 0.7Hz typ.)					

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	60 Seconds	1500	---	---	VDC
	1 Second	1800	---	---	VDC
I/O Isolation Resistance	500 VDC	1000	---	---	MΩ
I/O Isolation Capacitance	100kHz, 1V	---	---	2000	pF
Switching Frequency		---	285	---	kHz
MTBF(calculated)	MIL-HDBK-217F@25℃, Ground Benign	313,300			Hours
Safety Approvals	UL/cUL 60950-1 recognition(CSA certificate), IEC/EN 60950-1(CB-report)				
	UL/cUL 62368-1 recognition(UL certificate), IEC/EN 62368-1(CB-report)				

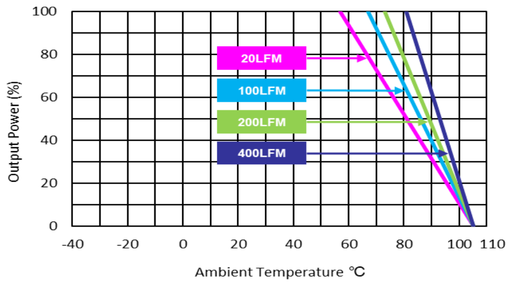
EMC Specifications

Parameter	Standards & Level				Performance
$EMI_{(6)}$	Conduction	EN 55032		With external components	Class A
	Radiation				
$EMS_{(6)}$	EN 55035				
	ESD	EN61000-4-2 Air ± 8kV, Contact ±6kV			A
	Radiated immunity	EN 61000-4-3 10V/m			A
	Fast transient	EN 61000-4-4 ±2kV			A
	Surge	EN 61000-4-5 ±1kV			A
	Conducted immunity	EN 61000-4-6 10Vrms			A

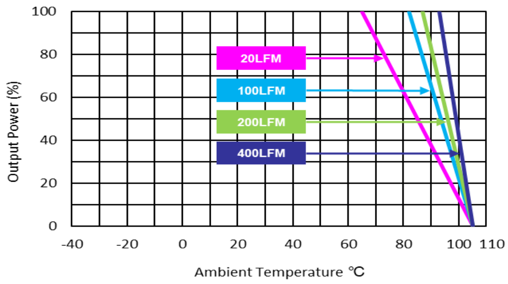
Environmental Specifications

Parameter	Conditions / Model	Min.	Max.		Unit
			without Heatsink	with Heatsink	
Operating Ambient Temperature Range Nominal Vin, Load 100% Inom. (for Power Derating see relative Derating Curves)	MJW25-24S033, MJW25-48S033	-40	57	65	℃
	MJW25-24S05, MJW25-24S12 MJW25-24S15, MJW25-48S05 MJW25-48S12, MJW25-48S15		56	64	
	MJW25-12S033		53	61	
	MJW25-12S05, MJW25-12S12, MJW25-12S15 MJW25-12D12, MJW25-12D15 MJW25-24D12, MJW25-24D15 MJW25-48D12, MJW25-48D15		50	59	
Thermal Impedance	20LFM Convection without Heatsink	17.6	---		℃/W
	20LFM Convection with Heatsink	14.8	---		℃/W
	100LFM Convection without Heatsink	13.6	---		℃/W
	100LFM Convection with Heatsink	8.5	---		℃/W
	200LFM Convection without Heatsink	11.8	---		℃/W
	200LFM Convection with Heatsink	6.5	---		℃/W
	400LFM Convection without Heatsink	8.8	---		℃/W
	400LFM Convection with Heatsink	4.3	---		℃/W
Case Temperature		---	+105		℃
Storage Temperature Range		-50	+125		℃
Humidity (non condensing)		---	95		% rel. H
RFI	Six-Sided Shielded, Metal Case				
Lead Temperature (1.5mm from case for 10Sec.)		---	260		℃

Power Derating Curve

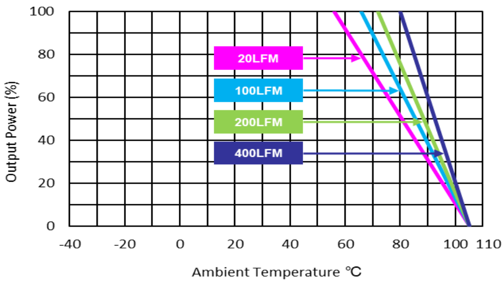


MJW25-24S033, MJW25-48S033
Derating Curve without Heatsink

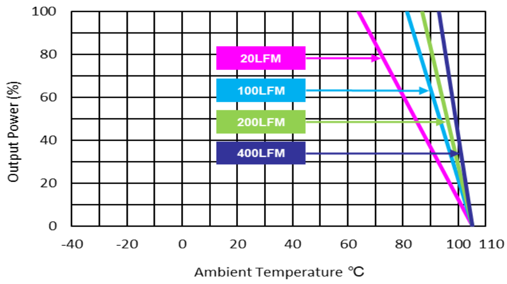


MJW25-24S033, MJW25-48S033
Derating Curve with Heatsink

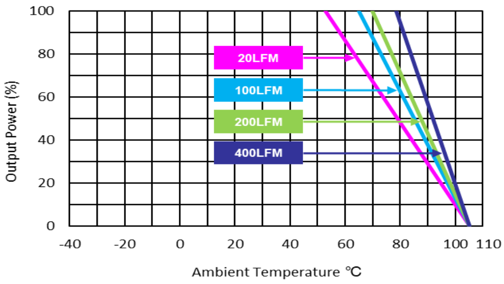
Power Derating Curve



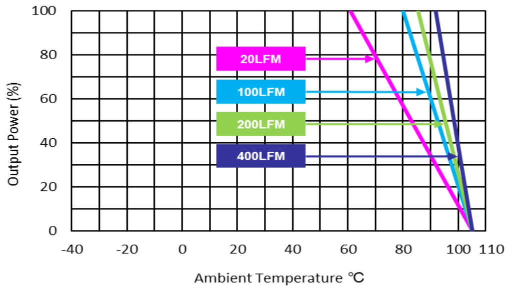
MJW25-24S05, MJW25-24S12, MJW25-24S15
MJW25-48S05, MJW25-48S12, MJW25-48S15
Derating Curve without Heatsink



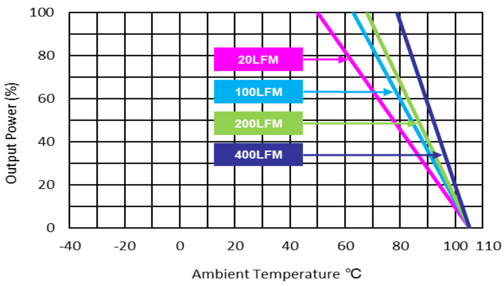
MJW25-24S05, MJW25-24S12, MJW25-24S15
MJW25-48S05, MJW25-48S12, MJW25-48S15
Derating Curve with Heatsink



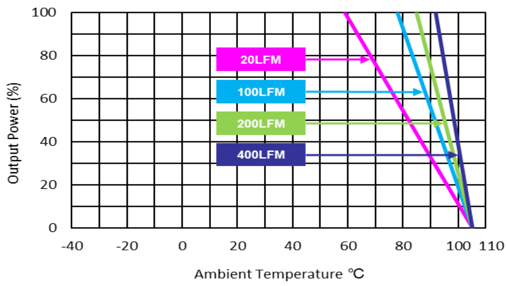
MJW25-12S033 Derating Curve without Heatsink



MJW25-12S033 Derating Curve with Heatsink



MJW25-12S05, MJW25-12S12, MJW25-12S15
MJW25-12D12, MJW25-12D15, MJW25-24D12
MJW25-24D15, MJW25-48D12, MJW25-48D15
Derating Curve without Heatsink



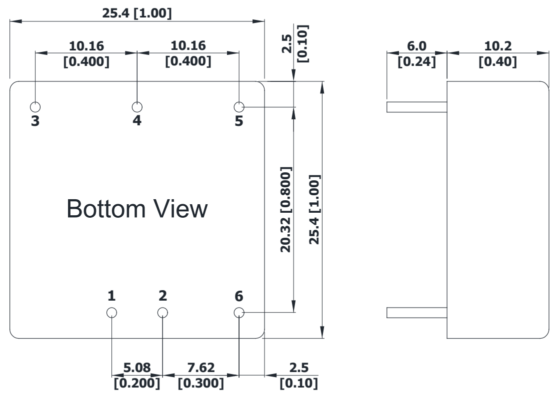
MJW25-12S05, MJW25-12S12, MJW25-12S15
MJW25-12D12, MJW25-12D15, MJW25-24D12
MJW25-24D15, MJW25-48D12, MJW25-48D15
Derating Curve with Heatsink

Notes

1. Specifications typical at Ta=+25℃, resistive load, nominal input voltage, rated output current unless otherwise noted.
2. Transient recovery time is measured to within 1% error band for a step change in output load of 75% to 100%.
3. Ripple & Noise measurement with a 1μF/50V MLCC and a 10μF Tantalum Capacitor.
4. We recommend to protect the converter by a slow blow fuse in the input supply line.
5. Other input and output voltage may be available, please contact MINMAX
6. The external components might be required to meet EMI/EMS standard for some of test items. Please contact MINMAX for the solution in detail.
7. Specifications are subject to change without notice.
8. The repeated high voltage isolation testing of the converter can degrade isolation capability, to a lesser or greater degree depending on materials, construction, environment and reflow solder process. Any material is susceptible to eventual chemical degradation when subject to very high applied voltages thus implying that the number of tests should be strictly limited. We therefore strongly advise against repeated high voltage isolation testing, but if it is absolutely required, that the voltage be reduced by 20% from specified test voltage. Furthermore, the high voltage isolation capability after reflow solder process should be evaluated as it is applied on system.

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output	Diameter mm (inches)
1	+Vin	+Vin	Ø 1.0 [0.04]
2	-Vin	-Vin	Ø 1.0 [0.04]
3	+Vout	+Vout	Ø 1.0 [0.04]
4	Trim	Common	Ø 1.0 [0.04]
5	-Vout	-Vout	Ø 1.0 [0.04]
6	Remote On/Off	Remote On/Off	Ø 1.0 [0.04]

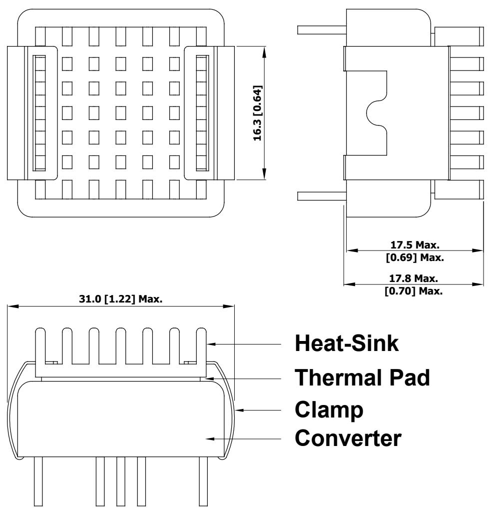
- All dimensions in mm (inches)
- Tolerance: X.X±0.5 (X.XX±0.02)
  X.XX±0.25 (X.XXX±0.01)
- Pin diameter tolerance: X.X±0.05 (X.XX±0.002)

Physical Characteristics

Case Size	:	25.4x25.4x10.2mm (1.0x1.0x0.4 inches)
Case Material	:	Metal With Non-Conductive Baseplate
Base Material	:	FR4 PCB (flammability to UL 94V-0 rated)
Pin Material	:	Copper Alloy
Weight	:	16.5g

Heatsink (Option –HS)

Mechanical Dimensions



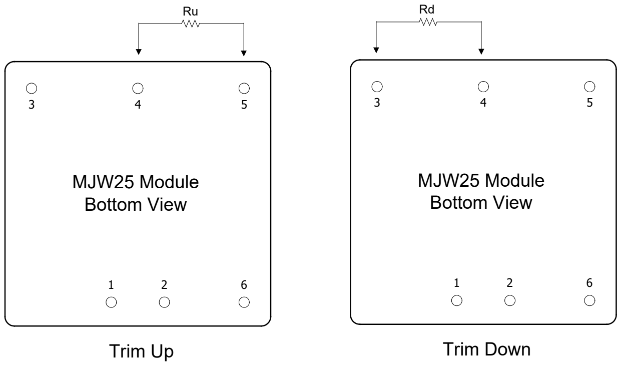
Heatsink Material: Aluminum
Finish: Anodic treatment (black)
Weight: 2g

- The advantages of adding a heatsink are:

1. To improve heat dissipation and increase the stability and reliability of the DC-DC converters at high operating temperatures.
2. To increase Operating temperature of the DC-DC converter, please refer to Derating Curve.

External Output Trimming

Output can be externally trimmed by using the method shown below



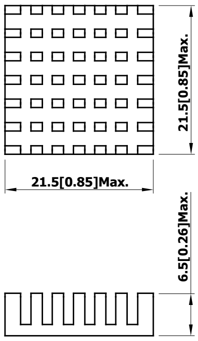
	MJW25-XXS033		MJW25-XXS05		MJW25-XXS12		MJW25-XXS15	
Trim Range (%)	Trim down (kΩ)	Trim up (kΩ)	Trim down (kΩ)	Trim up (kΩ)	Trim down (kΩ)	Trim up (kΩ)	Trim down (kΩ)	Trim up (kΩ)
1	72.61	60.84	138.88	106.87	413.55	351.00	530.73	422.77
2	32.55	27.40	62.41	47.76	184.55	157.50	238.61	189.89
3	19.20	16.25	36.92	28.06	108.22	93.00	141.24	112.26
4	12.52	10.68	24.18	18.21	70.05	60.75	92.56	73.44
5	8.51	7.34	16.53	12.30	47.15	41.40	63.35	50.15
6	5.84	5.11	11.44	8.36	31.88	28.50	43.87	34.63
7	3.94	3.51	7.79	5.55	20.98	19.29	29.96	23.54
8	2.51	2.32	5.06	3.44	12.80	12.37	19.53	15.22
9	1.39	1.39	2.94	1.79	6.44	7.00	11.41	8.75
10	0.50	0.65	1.24	0.48	1.35	2.70	4.92	3.58

Order Code Table

Standard	With heatsink
MJW25-12S033	MJW25-12S033-HS
MJW25-12S05	MJW25-12S05-HS
MJW25-12S12	MJW25-12S12-HS
MJW25-12S15	MJW25-12S15-HS
MJW25-12D12	MJW25-12D12-HS
MJW25-12D15	MJW25-12D15-HS
MJW25-24S033	MJW25-24S033-HS
MJW25-24S05	MJW25-24S05-HS
MJW25-24S12	MJW25-24S12-HS
MJW25-24S15	MJW25-24S15-HS
MJW25-24D12	MJW25-24D12-HS
MJW25-24D15	MJW25-24D15-HS
MJW25-48S033	MJW25-48S033-HS
MJW25-48S05	MJW25-48S05-HS
MJW25-48S12	MJW25-48S12-HS
MJW25-48S15	MJW25-48S15-HS
MJW25-48D12	MJW25-48D12-HS
MJW25-48D15	MJW25-48D15-HS

Order Code For Heatsink kit (including: Heatsink x1, Clamp x 2, Thermal Pad x1)

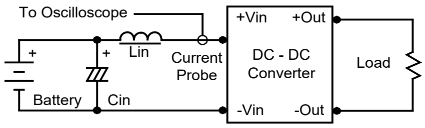
HS-J001



Test Setup

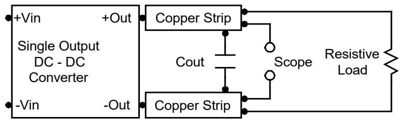
Input Reflected-Ripple Current Test Setup

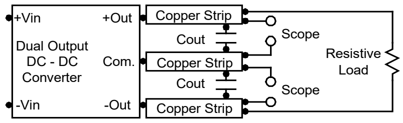
Input reflected-ripple current is measured with a inductor Lin (4.7μH) and Cin (220μF, ESR < 1.0Ω at 100 kHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 kHz.



Peak-to-Peak Output Noise Measurement Test

Use a 1μF ceramic capacitor and a 10μF tantalum capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20 MHz. Position the load between 50 mm and 75 mm from the DC-DC Converter.





Technical Notes

Remote On/Off

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is 0V to 1.2V. A logic high is 3.5V to 12V. The maximum sink current at the on/off terminal (Pin 6) during a logic low is -500uA. The maximum allowable leakage current of a switch connected to the on/off terminal (Pin 6) at logic high (3.5V to 12V) is 10mA.

Overload Protection

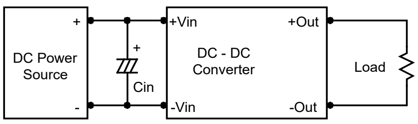
To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

Overvoltage Protection

The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals. The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

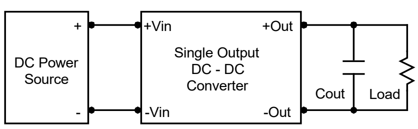
Input Source Impedance

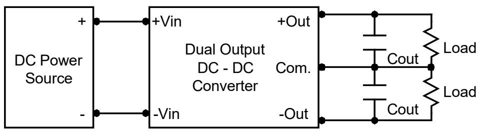
The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module. In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup. Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 kHz) capacitor of a 10μF for the 24V and 48V devices.



Output Ripple Reduction

A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 4.7μF capacitors at the output.





Maximum Capacitive Load

The MJW25 series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the data sheet.

Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105°C. The derating curves are determined from measurements obtained in a test setup.