

FLUKE®

Calibration

52120A Transconductance Amplifier



Extended Specifications

52120A performance at a glance

- Industry-leading amplifier accuracy:
 - 140 ppm ac (used with 61XXA Electrical Power Standard)
 - 350 ppm ac (used with dc/lf calibrator)
 - 160 ppm dc (used with dc/lf calibrator)
- Frequency: to 10 kHz
- Burden voltage (compliance): 4.5 V @ 120 A
- Inductive drive capability: 1 mH load
- Output ranges: 2 A, 20 A, 120 A
- Input ranges: 2 V or 200 mA F.S. for 2 A and 20 A ranges, 1.2 V or 120 mA F.S. for 120 A range
- Parallel operation: 2 or 3, up to 360 A in a single phase
- Accessory coils: 25-turn coil supports 3000 A, 50-turn coil supports 6000 A
- Control communication with 6105A /6100B Electrical Power Standards
- GPIB remote operation

General Specifications

Line Power

Voltage range.....	100 V to 240 V
Frequency.....	47 to 63 Hz
Voltage variations.....	+10 % about line voltage
Power consumption.....	<1500 VA
Transient overvoltage.....	Impulse withstand (overvoltage) Category II of IEC 60364-4-443

Dimensions (HxWxD)

With feet.....	192 mm x 432 mm x 645 mm (7.6 in x 17.0 in x 25.5 in)
Without feet.....	178 mm x 432 mm x 645 mm (7.0 in x 17.0 in x 25.5 in)

Weight.....25 kg (54 lb)

Temperature

Operating.....	5 °C to 35 °C (41 °F to 95 °F)
Calibration (tcal).....	16 °C to 30 °C (61 °F to 86 °F)
Storage.....	0 °C to 50 °C (32 °F to 122 °F)
Transit.....	-20 °C to +60 °C (-4 °F to +140 °F) <100 hours

Warmup Time.....Twice the time since last warmed up, to a maximum of 1 hour.

Humidity (non-condensing)

Operating.....	<80 %, 5 °C to 31 °C (41 °F to 88 °F) ramping linearly down to 50 % at 35 °C (95 °F)
Storage.....	<95 %, 0 to 50 °C (32 °F to 122 °F)

Altitude


Operating.....	2,500 m (8,200 ft) maximum
Non-Operating.....	12,000 m (39,400 ft) maximum

Shock and Vibration.....MIL-PRF-28800F Class 3

Safety.....Complies with EN/IEC 61010-1:2010, CAN/CSA C22.2 No. 61010-1-04, ANSI/UL 61010-1:2004

EMC.....Complies with EN 61326-1:2006, CISPR 11 (EN 55011:2004), FCC rules part 15, sub part B, Class A

Indoor user only.....Pollution degree 2

Agency Approvals.....CE, 

Electrical Performance Limits

Voltage compliance developed across inductive loads may prevent range maximum current output being achieved at higher frequencies. The appropriate maximum frequency (F_{max}) for a given load inductance and current is given by:

$$F_{max} = \frac{4.5}{2 \cdot \pi \cdot I \cdot L}$$

I = Current

L = Total inductance

The maximum frequency calculated with this equation is only approximate. Series resistance and parallel capacitance also affect the maximum achievable frequency.

Input common mode rejection..... 80 dB @ DC decreasing linearly to 40 dB at 10 kHz

Input Impedance

Voltage input > 1 MΩ

Current input..... 10 Ω

Maximum output compliance voltage..... 4.5 V rms (6.4 V pk), 6.4 V dc. 120 A range maximum compliance voltage decreases from 4.5 V at 1 kHz to about 3 V at 10 kHz

DC Offset..... Magnetic remanence that follows abrupt changes in output current level may cause small changes to DC current offset. It is good practice to correct for offsets in DC measurements and techniques such as DC reversal measurement will result in best accuracy.

Operating Limits

	Output Current Range		
	2 A	20 A	120 A
Current Output (Max.)	2 A rms	20 A rms	120 A rms
	Current Input		
Input Current (Max.)	200 mA rms	200 mA rms	120 mA rms
Current gain	10	100	1,000
	Voltage Input		
Input Voltage (Max.)	2 V rms	2 V rms	1.2 V rms
Transconductance	1 Siemen	10 Siemens	100 Siemens

120 A Range Current/Frequency Limits

Frequency	Maximum Output Current	Maximum Current Input	Maximum Voltage Input
DC	±100 A	±100 mA	±1.0 V
< 10 Hz	100 A pk (70 A rms)	100 mA pk (70 mA rms)	1.0 V pk (0.7 V rms)
10 Hz to 10 kHz	170 A pk (120 A rms)	170 mA pk (120 mA rms)	1.7 V pk (1.2 V rms)

Note: The 2 A and 20 A ranges operate at full output current from DC to 10 kHz.

Output Isolation

Frequency	Maximum Voltage Signal Applied to any Output Current Terminal with respect to Earth
DC to 850 Hz	600 V rms, 850 V pk, limited 2 A rms, no transient overvoltages
850 Hz to 3 kHz	100 V rms, 142 V pk, limited 2 A rms, no transient overvoltages
3 kHz to 10 kHz	33 V rms, 47 V pk, limited 2 A rms, no transient overvoltages

Performance Specifications

Operated within 6105A or 6100B Control Loop, Sine or Harmonic Input (all current ranges)

The current and phase angle accuracies of the 52120A when controlled by a single 610X, apply to the parallel output of up to three 52120As connected as slaves. See the 610X specifications for interharmonic, fluctuating harmonic, dip and flicker specifications.

Coverage factor k=2.58 (99 % confidence level)

Current Accuracy

Frequency	1-year accuracy, $t_{cal}^{[1]} \pm 5\text{ }^\circ\text{C} \pm (\% \text{ of output} + \% \text{ of range})$			
	6105B		6100B	
	% of output	% of range	% of output	% of range
DC	0.015	0.010	0.022	0.025
10 Hz to 850 Hz	0.011	0.003	0.018	0.003
850 Hz to 6 kHz	0.052	0.005	0.052	0.005
6 kHz to 9 kHz	See Operated Stand Alone current accuracy table.			
[1] t_{cal} is the temperature at which calibration adjustment took place.				
Notes: Maximum inductance for stability LCOMP OFF is 100 μH . Maximum inductance for stability LCOMP ON is 400 μH for 2 A and 20 A ranges. 100 μH on the 120 A range.				

Phase Angle Accuracy

Frequency	Accuracy
10 Hz to 69 Hz	0.006 °
69 Hz to 180 Hz	0.012 °
180 Hz to 450 Hz	0.025 °
450 Hz to 850 Hz	0.045 °
850 Hz to 3 kHz	0.325 °
3 kHz to 6 kHz	0.645 °

Coverage factor k=2.00 (95 % confidence level)

Current Accuracy

Frequency	1-year accuracy, $t_{cal}^{[1]} \pm 5\text{ }^\circ\text{C} \pm (\% \text{ of output} + \% \text{ of range})$			
	6105B		6100B	
	% of output	% of range	% of output	% of range
DC	0.012	0.008	0.017	0.019
10 Hz to 850 Hz	0.009	0.002	0.021	0.002
850 Hz to 6 kHz	0.040	0.004	0.040	0.004
6 kHz to 9 kHz	See Operated Stand Alone current accuracy table.			
[1] t_{cal} is the temperature at which calibration adjustment took place.				
Notes: Maximum inductance for stability LCOMP OFF is 100 μH . Maximum inductance for stability LCOMP ON is 400 μH for 2 A and 20 A ranges. 100 μH on the 120 A range.				

Phase Angle Accuracy

Frequency	Accuracy
10 Hz to 69 Hz	0.005 °
69 Hz to 180 Hz	0.009 °
180 Hz to 450 Hz	0.020 °
450 Hz to 850 Hz	0.035 °
850 Hz to 3 kHz	0.250 °
3 kHz to 6 kHz	0.500 °

Maximum load dependent phase shift..... <0.001 ° @ 60 Hz; increasing linearly to 0.006 ° @ 6 kHz.

Maximum Distortion and Noise

Frequency	Distortion ^[1]				Noise 16 Hz to 10 MHz
	LCOMP OFF		LCOMP ON		
	dB	Current	dB	Current	
2 Amp Range					
16 Hz to 850 Hz	-76	42 µA	-70	83 µA	-60 dB
850 Hz to 6 kHz	-52	662 µA	-46	1.3 mA	-60 dB
6 kHz to 10 kHz ^[2]	-40	2.6 mA	-35	4.7 mA	-60 dB
20 Amp Range					
16 Hz to 850 Hz	-76	418 µA	-60	2.6 mA	-70 dB
850 Hz to 6 kHz	-52	6.6 mA	-42	20.9 mA	-70 dB
6 kHz to 10 kHz ^[2]	-40	26.4 mA	-35	46.9 mA	-70 dB
120 Amp Range					
16 Hz to 850 Hz	-76	2.5 mA	-60	15.8 mA	-70 dB
850 Hz to 6 kHz	-52	39.7 mA	-42	125.7 mA	-70 dB
6 kHz to 10 kHz ^[2]	-40	158.2 ma	-35	281.3 mA	-70 dB

[1] Use dB or Current. Whichever is larger.
 [2] Interharmonics only above 6 kHz.

Operated Stand Alone

The stand-alone specifications are stated for the accuracy of transconductance with a voltage input, or current gain with a current input. These specifications do not include the errors of the instrument that provides the voltage or current signal to the Product input. To get the absolute accuracy of the current output, combine the source and Product specifications with the "root sum of squares" (RSS) method found in the *52120A Users Manual*.

Up to ten 52120As (one master and nine slaves) can be chained together in stand-alone mode. Any additional slave units are ignored by the control system.

Coverage factor k=2.58 (99 % confidence level)

Current Accuracy

Frequency	Accuracy ±5 °C ±(% of output + % of range)		
	% of Output	% of Range	
		LCOMP OFF ^[2]	LCOMP ON ^[3]
2 Amp Range			
DC	0.010	0.005	0.005
10 Hz to 65 Hz	0.015	0.070	0.300
65 Hz to 300 Hz	0.030	0.070	0.500
300 Hz to 1 kHz	0.100	0.070	3.500
1 kHz to 3 kHz	0.300	0.600	Not Specified
3 kHz to 6 kHz	1.000	1.600	Not Specified
6 kHz to 10 kHz	2.000	4.000	Not Specified
20 Amp Range			
DC	0.010	0.005	0.005
10 Hz to 65 Hz	0.015	0.060	0.300
65 Hz to 300 Hz	0.030	0.060	1.200
300 Hz to 1 kHz	0.100	0.060	6.000
1 kHz to 3 kHz	0.300	0.200	Not Specified
3 kHz to 6 kHz	1.000	0.400	Not Specified
6 kHz to 10 kHz	3.000	0.600	Not Specified
120 Amp Range			
DC	0.010	0.005	0.005
10 Hz to 65 Hz	0.015	0.020	0.500
65 Hz to 300 Hz	0.030	0.030	0.700
300 Hz to 1 kHz	0.100	0.100	3.500
1 kHz to 3 kHz	0.300	0.250	Not Specified
3 kHz to 6 kHz	1.000	0.450	Not Specified
6 kHz to 10 kHz	4.000	0.750	Not Specified

[1] tcal is the temperature at which calibration adjustment took place.
 [2] Maximum inductance for stability LCOMP OFF is 100 µH.
 [3] Maximum inductance for stability LCOMP ON is 1 mH.

Coverage factor k=2.00 (95 % confidence level)

Current Accuracy

Frequency	Accuracy 1-year accuracy, tcal ^[1] ±5 °C ±[% of output + % of range]		
	% of Output	% of Range	
		LCOMP OFF ^[2]	LCOMP ON ^[3]
2 Amp Range			
DC	0.008	0.004	0.004
10 Hz to 65 Hz	0.012	0.054	0.233
65 Hz to 300 Hz	0.023	0.054	0.390
300 Hz to 1 kHz	0.078	0.054	2.720
1 kHz to 3 kHz	0.233	0.465	Not Specified
3 kHz to 6 kHz	0.775	1.240	Not Specified
6 kHz to 10 kHz	1.550	3.100	Not Specified
20 Amp Range			
DC	0.008	0.004	0.004
10 Hz to 65 Hz	0.012	0.047	0.233
65 Hz to 300 Hz	0.023	0.047	1.200
300 Hz to 1 kHz	0.078	0.047	6.000
1 kHz to 3 kHz	0.233	0.155	Not Specified
3 kHz to 6 kHz	0.775	0.310	Not Specified
6 kHz to 10 kHz	2.330	0.470	Not Specified
120 Amp Range			
DC	0.008	0.004	0.004
10 Hz to 65 Hz	0.012	0.016	0.390
65 Hz to 300 Hz	0.023	0.023	0.700
300 Hz to 1 kHz	0.078	0.078	3.500
1 kHz to 3 kHz	0.233	0.194	Not Specified
3 kHz to 6 kHz	0.775	0.349	Not Specified
6 kHz to 10 kHz	3.101	0.581	Not Specified
[1] tcal is the temperature at which calibration adjustment took place. [2] Maximum inductance for stability LCOMP OFF is 100 µH. [3] Maximum inductance for stability LCOMP ON is 1 mH.			

Distortion

Frequency	LCOMP OFF		LCOMP ON	
10 Hz to 65 Hz	-60 dB	0.1 %	-60 dB	0.1 %
65 Hz to 300 Hz	-60 dB	0.1 %	-50 dB	0.3 %
300 Hz to 1 kHz	-54 dB	0.2 %	-50 dB	0.3 %
1 kHz to 3 kHz	-46 dB	0.5 %	Not Specified	
3 kHz to 6 kHz	-46 dB	0.5 %	Not Specified	
6 kHz to 10 kHz	-40 dB	1.0 %	Not Specified	
Note Distortion specifications apply to output at full range measured in a 50 kHz bandwidth.				

52120A/COIL 3 KA 25-Turn Coil

Number of turns 25

Minimum internal jaw dimension to clear wires .26 mm (width) x 36 mm (length)

Maximum input current..... 120 A continuous with built-in 12 V fan on

Maximum voltage..... 4.5 V rms

Accuracy

Input Current ^[1]	Frequency	Effective Current Amp-turns	52120A + Coil Accuracy ^[2]	
			±(% of Amp-turns + % of 52120A range)	
			% of Amp-turns	% of 52120A Range
0 A to 100 A	DC	0 to 2500	0.7 %	0.7 %
0 A to 120 A	10 Hz to 65 Hz	0 to 3000	0.7 %	0.7 %
0 A to 120 A	65 Hz to 300 Hz	0 to 3000	0.7 %	0.7 %
0 A to 40 A	300 Hz to 1 kHz	0 to 1000	0.7 %	0.7 %
0 A to 12 A	1 kHz to 3 kHz	0 to 300	0.8 %	1.0 %
0 A to 3 A	3 kHz to 6 kHz	0 to 100	1.5 %	1.0 %
0 A to 1 A	6 kHz to 10 kHz	0 to 50	5.0 %	1.0 %

[1] The inductance and mutual inductance of the 25 turn coil and clamp that is measured causes a frequency dependent compliance voltage across the coil. The length and configuration of the cables that connect the current to the coil also have an effect. Maximum input current is 120 A input at approximately 100 Hz. Maximum current input decreases to approximately 0.8 A at 10 kHz.

[2] Includes coil/clamp interaction.

52120A/COIL 6 KA 50-Turn Coil

Number of turns 50

Minimum flexible probe length..... 500 mm

Maximum input current..... 120 A continuous with built-in 12 V fan on

Maximum voltage..... 4.5 V rms

Accuracy

Input Current ^[1]	Frequency	Effective Current Amp-turns	52120A + Coil Accuracy ^[2]	
			±(% of Amp-turns + % of 52120A range)	
			% of Amp-turns	% of 52120A Range
0 A to 100 A	DC	0 to 5000	0.7 %	0.7 %
0 A to 120 A	10 Hz to 65 Hz	0 to 6000	0.7 %	0.7 %
0 A to 120 A	65 Hz to 300 Hz	0 to 6000	0.7 %	0.7 %
0 A to 120 A	300 Hz to 1 kHz	0 to 6000	0.7 %	0.7 %
0 A to 120 A	1 kHz to 3 kHz	0 to 3500	0.8 %	1.0 %
0 A to 25 A	3 kHz to 6 kHz	0 to 1250	1.5 %	1.0 %
0 A to 13 A	6 kHz to 10 kHz	0 to 600	5.0 %	1.0 %

[1] The inductance and mutual inductance of the 50 turn coil causes a frequency dependent compliance voltage across the coil. Maximum frequency for 120 A input current is approximately 600 Hz. Maximum current input decreases to approximately 13 A at 10 kHz.

[2] Includes coil/probe interaction.

Note

The specifications for these coils are at 99 % confidence level and are the combined accuracy of the coil and a 52120A. If the coils are used with other current sources the calibration uncertainty of the coils alone is 0.65 % (99 % confidence level) from 0 Hz to 10 kHz.

Ordering information

Models

52120A Transconductance Amplifier, 120A

Options and accessories

52120A/COIL3KA Coil, 25 turn, 3000 Amp
 52120A/COIL6KA Coil, 50 turn, 6000 Amp
 52120A/COIL12V Coil 12 V DC Supply
 GCP 52120 CarePlan one year
 G3P 52120 CarePlan three years

Fluke Calibration. *Precision, performance, confidence.™*

Electrical	RF	Temperature	Pressure	Flow	Software
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