

# Sorensen XFR Series

1.2–2.8 kW

## Low Profile DC Power Supply with Zero Voltage “Soft Switching”

6–600 V

- Analog programming
- Zero voltage “soft switching”
- Constant voltage or constant current operation with automatic crossover and mode indication
- Standby/Remote/Local modes
- Front panel button preview of voltage, current, OVP
- Remote sense, 5 V line loss compensation
- LabVIEW® and LabWindows® drivers



2–300 A

|   |     |     |     |
|---|-----|-----|-----|
| ~ | 110 | 208 | 230 |
| ⚡ |     | 208 | 230 |

ETHERNET ↔ GPIB ↔ RS232

The Sorensen XFR Series provides 1.2 kilowatts and 2.8 kilowatts of power for research, product development, and production test applications such as magnet control, ATE, process control, electroplating and burn-in. The XFR Series is ideal for applications where high power and a wide adjustment of output voltage or current is required.

The XFR Series features zero voltage “soft switching” which virtually eliminates switching transients, resulting in lower noise performance that is closer to linear levels. Soft switching also increases efficiency, decreases heat generation, and reduces stress on the switching transistors – resulting in higher reliability.

The XFR Series is designed for excellent thermal management so each unit can be conveniently stacked in rack mounts without leaving ventilation space between each unit.

**AMETEK**  
**Programmable Power**  
 9250 Brown Deer Road  
 San Diego, CA 92121-2267  
 USA



# XFR Series : Product Specifications

| Common                                      |  |  |
|---|--|--|
| Switching Frequency                         | XFR 2.8 kW: Nominal 31 kHz (62 kHz output ripple) XFR 1.2 kW: 6 V to 40 V models: nominal 78 kHz (156 kHz output ripple); 60 V to 600 V models: nominal 62.5 kHz (125 kHz output ripple).  |  |
| Time Delay                                  | 7 sec maximum from power on until output stable  |  |
| Voltage Mode Transient Response Time        | < 3 ms for output voltage to recover within 0.5% of its rated voltage after a step change in load current of up to 10% to 90% of rated output  |  |
| Maximum Voltage Differential                | ±600 Vdc from output to safety ground  |  |
| Remote Start/Stop and Interlock             | 2.5-15 V signal or TTL-compatible input, selectable logic  |  |
| Remote Analog Programming                   | Voltage and current programming inputs (source must be isolated): 0-5 k, 0-10 k resistances; 0-5 V, 0-10 V (default) voltage sources   |  |
| Remote Analog Monitoring                    | Voltage and current monitor outputs 0-5 V, 0-10 V (default) ranges for 0-100% of output  |  |
| Remote Programming & Monitoring Accuracy    | 1% zero to full scale output for the default range   |  |
| Maximum Remote Sense Line Drop Compensation | 5 V / line (Line drop is subtracted from total voltage available at supply output.)  |  |
| Front Panel Voltage and Current Control     | 10-turn voltage and current potentiometers   |  |
| Front Panel Voltage Control Resolution      | 0.02% of maximum voltage   |  |
| Main Output Connector                       | XFR 2.8 kW: 7.5 - 100 V models: nickel-plated copper bus bars with bus bar cover and strain relief; 150V to 600 V models: 4-terminal, wire clamp connector with cover and strain relief; XFR 1.2 kW: 6 - 40 V models: nickel-plated copper bus bars with bus bar shield; 60 - 600 V models: 4-terminal wire clamp connector with strain relief |  |
| Approvals                                   | NRTL approved and CE-marked to UL Std. No. 61010-1, CAN/CSA-C22.2 No. 61010-1-04, EN 61010-1 (Equipment Class I, Pollution Degree 2, Installation Category II) Meets USA EMC standard: FCC, part 15B, Class A; Meets Canadian EMC standard: ICES-001, Class A.   |  |
| Input                                       |  |  |
| Input Voltage Ranges                        | XFR 2.8 kW: 190-264 Vac, 1 $\phi$ (24.3 A @ 208 Vac; 20.5 A @ 230 Vac typical), 47-63 Hz; Option: M2 3 $\phi$ 208 Vac input<br>XFR 1.2 kW: 85-130 Vac or 190-264 Vac, 1 $\phi$ (17 A @ 120 Vac; 8.8 A @ 230 Vac typical), 47-63 Hz. Automatic range detect.  |  |
| AC Input Connector                          | Type 3-terminal, 34 A, 250 V, wire clamp connector with strain relief cover  |  |
| Protection Features                         |  |  |
| Over-voltage protection                     |  |  |
| Over-temperature protection                 |  |  |
| Environmental                               |  |  |
| Operating Temperature                       | XFR 2.8 kW: 0 to 50°C, XFR 1.2 kW: 0 to 50°C; 6 V model: for rack mounted units, derate output current by 1.5 A per °C for operating temperatures between 30 - 50°C  |  |
| Storage Temperature                         | -20°C to 70°C  |  |
| Humidity (Non-condensing)                   | Up to 90% RH, non-condensing   |  |
| Physical                                    | XFR 2.8 kW   | XFR 1.2 kW   |
| Dimensions                                  | Width: 19" (429.4 mm)<br>Height: 3.5" (88.9 mm)<br>Depth: 21" (533.5 mm)   | Width: 19" (429.4 mm)<br>Height: 1.7" (43.2 mm)<br>Depth: 20" (508.1 mm) |
| Weight                                      | 33 lb (15 kg)  | 18 lb (8.2 kg)   |

# XFR Series : Product Specifications

1.2–2.8 kW

| Model       | Output Voltage               | Output Current       | Output Power                   | Line Regulation <sup>2</sup>   |         |
|-------------|------------------------------|----------------------|--------------------------------|--------------------------------|---------|
|             |                              |                      |                                | Voltage                        | Current |
| XFR 6-200   | 0-6 V                        | 0-200 A <sup>8</sup> | 1200 W                         | 2.6 mV                         | 22 mA   |
| XFR 7.5-140 | 0-7.5 V                      | 0-140 A              | 1050 W                         | 2.75 mV                        | 16 mA   |
| XFR 12-100  | 0-12 V                       | 0-100 A              | 1200 W                         | 3.2 mV                         | 12 mA   |
| XFR 20-60   | 0-20 V                       | 0-60 A               | 1200 W                         | 4 mV                           | 8 mA    |
| XFR 35-35   | 0-35 V                       | 0-35 A               | 1225 W                         | 5.5 mV                         | 5.5 mA  |
| XFR 40-30   | 0-40 V                       | 0-30 A               | 1200 W                         | 6 mV                           | 5 mA    |
| XFR 60-20   | 0-60 V                       | 0-20 A               | 1200 W                         | 8 mV                           | 4 mA    |
| XFR 100-12  | 0-100 V                      | 0-12 A               | 1200 W                         | 12 mV                          | 3.2 mA  |
| XFR 150-8   | 0-150 V                      | 0-8 A                | 1200 W                         | 17 mV                          | 2.8 mA  |
| XFR 300-4   | 0-300 V                      | 0-4 A                | 1200 W                         | 32 mV                          | 2.4 mA  |
| XFR 600-2   | 0-600 V                      | 0-2 A                | 1200 W                         | 62 mV                          | 2.2 mA  |
| XFR 7.5-300 | 0-7.5 V                      | 0-300 A              | 2250 W                         | 2.75 mV                        | 32 mA   |
| XFR 12-220  | 0-12 V                       | 0-220 A              | 2640 W                         | 3.2 mV                         | 24 mA   |
| XFR 20-130  | 0-20 V                       | 0-130 A              | 2600 W                         | 4 mV                           | 15 mA   |
| XFR 33-85   | 0-33 V                       | 0-85 A               | 2805 W                         | 5.3 mV                         | 10.5 mA |
| XFR 40-70   | 0-40 V                       | 0-70 A               | 2800 W                         | 6 mV                           | 9 mA    |
| XFR 60-46   | 0-60 V                       | 0-46 A               | 2760 W                         | 8 mV                           | 6.6 mA  |
| XFR 100-28  | 0-100 V                      | 0-28 A               | 2800 W                         | 12 mV                          | 4.8 mA  |
| XFR 150-18  | 0-150 V                      | 0-18 A               | 2700 W                         | 17 mV                          | 3.8 mA  |
| XFR 300-9   | 0-300 V                      | 0-9 A                | 2700 W                         | 32 mV                          | 2.9 mA  |
| XFR 600-4   | 0-600 V                      | 0-4 A                | 2400 W                         | 62 mV                          | 2.4 mA  |
| Model       | Load Regulation <sup>3</sup> |                      | Meter Accuracy                 |                                |         |
|             | Voltage                      | Current              | Voltage (1% of Vmax + 1 count) | Current (1% of Imax + 1 count) |         |
| XFR 6-200   | 8.2 mV                       | 45 mA                | 0.07 V                         | 2.5 A                          |         |
| XFR 7.5-140 | 6.5 mV                       | 33 mA                | 0.09 V                         | 1.5 A                          |         |
| XFR 12-100  | 7.4 mV                       | 25 mA                | 0.13 V                         | 1.1 A                          |         |
| XFR 20-60   | 9 mV                         | 17 mA                | 0.3 V                          | 0.7 A                          |         |
| XFR 35-35   | 12 mV                        | 12 mA                | 0.4 V                          | 0.45 A                         |         |
| XFR 40-30   | 13 mV                        | 11 mA                | 0.5 V                          | 0.4 A                          |         |
| XFR 60-20   | 17 mV                        | 9 mA                 | 0.7 V                          | 0.3 A                          |         |
| XFR 100-12  | 27 mV                        | 7.4 mA               | 1.1 V                          | 0.13 A                         |         |
| XFR 150-8   | 35 mV                        | 6.6 mA               | 1.6 V                          | 0.09 A                         |         |
| XFR 300-4   | 65 mV                        | 5.8 mA               | 4 V                            | 0.05 A                         |         |
| XFR 600-2   | 125 mV                       | 5.4 mA               | 7 V                            | 0.03 A                         |         |
| XFR 7.5-300 | 6.5 mV                       | 65 mA                | 0.09 V                         | 4 A                            |         |
| XFR 12-220  | 7.4 mV                       | 49 mA                | 0.13 V                         | 2.3 A                          |         |
| XFR 20-130  | 9 mV                         | 31 mA                | 0.3 V                          | 1.4 A                          |         |
| XFR 33-85   | 11.6 mV                      | 22 mA                | 0.43 V                         | 0.95 A                         |         |
| XFR 40-70   | 13 mV                        | 19 mA                | 0.5 V                          | 0.8 A                          |         |
| XFR 60-46   | 17 mV                        | 14.2 mA              | 0.7 V                          | 0.56 A                         |         |
| XFR 100-28  | 27 mV                        | 10.6 mA              | 1.1 V                          | 0.38 A                         |         |
| XFR 150-18  | 35 mV                        | 8.6 mA               | 1.6 V                          | 0.19 A                         |         |
| XFR 300-9   | 65 mV                        | 6.8 mA               | 4 V                            | 0.1 A                          |         |
| XFR 600-4   | 125 mV                       | 5.8 mA               | 7 V                            | 0.05 A                         |         |

# XFR Series : Product Specifications

# 1.2–2.8 kW

| Model       | Output Noise (0-20MHz)       |   | Output Ripple (rms)           |                               |
|-------------|------------------------------|---|-------------------------------|-------------------------------|
|             | Voltage (p-p)                |   | Voltage                       | Current                       |
| XFR 6-200   | 75 mV                        |   | 9 mV                          | 750 mA                        |
| XFR 7.5-140 | 75 mV                        |   | 9 mV                          | 500 mA                        |
| XFR 12-100  | 75 mV                        |   | 9 mV                          | 500 mA                        |
| XFR 20-60   | 75 mV                        |   | 9 mV                          | 500 mA                        |
| XFR 35-35   | 120 mV                       |   | 9 mV                          | 300 mA                        |
| XFR 40-30   | 150 mV                       |   | 9 mV                          | 200 mA                        |
| XFR 60-20   | 150 mV                       |   | 9 mV                          | 100 mA                        |
| XFR 100-12  | 150 mV                       |   | 9 mV                          | 100 mA                        |
| XFR 150-8   | 150 mV                       |   | 18 mV                         | 50 mA                         |
| XFR 300-4   | 200 mV                       |   | 27 mV                         | 25 mA                         |
| XFR 600-2   | 400 mV                       |   | 72 mV                         | 15 mA                         |
| XFR 7.5-300 | 100 mV                       |   | 10 mV                         | 1600 mA                       |
| XFR 12-220  | 100 mV                       |   | 10 mV                         | 1200 mA                       |
| XFR 20-130  | 100 mV                       |   | 10 mV                         | 400 mA                        |
| XFR 33-85   | 100 mV                       |   | 15 mV                         | 300 mA                        |
| XFR 40-70   | 150 mV                       |   | 15 mV                         | 200 mA                        |
| XFR 60-46   | 150 mV                       |   | 15 mV                         | 100 mA                        |
| XFR 100-28  | 175 mV                       |   | 25 mV                         | 80 mA                         |
| XFR 150-18  | 200 mV                       |   | 25 mV                         | 40 mA                         |
| XFR 300-9   | 400 mV                       |   | 40 mV                         | 20 mA                         |
| XFR 600-4   | 500 mV                       |   | 100 mV                        | 10 mA                         |
| Model       | Drift (8 hours) <sup>4</sup> |   | Temp Coefficient <sup>5</sup> |                               |
|             | Voltage<br>(0.5% of Vmax)    | Current<br>(0.05% of I <sub>max</sub> ) | Voltage<br>(0.02% of Vmax °C) | Current<br>(0.03% of Vmax °C) |
| XFR 6-200   | 3 mV                         | 200 mA                                  | 1.2 mV                        | 60 mA                         |
| XFR 7.5-140 | 3.75 mV                      | 70 mA                                   | 1.5 mV                        | 42 mA                         |
| XFR 12-100  | 6 mV                         | 50 mA                                   | 2.4 mV                        | 30 mA                         |
| XFR 20-60   | 10 mV                        | 30 mA                                   | 4 mV                          | 18 mA                         |
| XFR 35-35   | 17.5 mV                      | 17.5 mA                                 | 7 mV                          | 10.5 mA                       |
| XFR 40-30   | 20 mV                        | 15 mA                                   | 8 mV                          | 9 mA                          |
| XFR 60-20   | 30 mV                        | 10 mA                                   | 12 mV                         | 6 mA                          |
| XFR 100-12  | 50 mV                        | 6 mA                                    | 20 mV                         | 3.6 mA                        |
| XFR 150-8   | 75 mV                        | 4 mA                                    | 30 mV                         | 2.4 mA                        |
| XFR 300-4   | 150 mV                       | 2 mA                                    | 60 mV                         | 1.2 mA                        |
| XFR 600-2   | 300 mV                       | 1 mA                                    | 120 mV                        | 0.6 mA                        |
| XFR 7.5-300 | 3.75 mV                      | 150 mA                                  | 1.5 mV                        | 90 mA                         |
| XFR 12-220  | 6 mV                         | 110 mA                                  | 2.4 mV                        | 66 mA                         |
| XFR 20-130  | 10 mV                        | 65 mA                                   | 4 mV                          | 39 mA                         |
| XFR 33-85   | 16.5 mA                      | 42.5 mA                                 | 6.6 mV                        | 25.5 mA                       |
| XFR 40-70   | 20 mV                        | 35 mA                                   | 8 mV                          | 21 mA                         |
| XFR 60-46   | 30 mV                        | 23 mA                                   | 12 mV                         | 13.8 mA                       |
| XFR 100-28  | 50 mV                        | 14 mA                                   | 20 mV                         | 8.4 mA                        |
| XFR 150-18  | 75 mV                        | 9 mA                                    | 30 mV                         | 5.4 mA                        |
| XFR 300-9   | 150 mV                       | 4.5 mA                                  | 60 mV                         | 2.7 mA                        |
| XFR 600-4   | 300 mV                       | 2 mA                                    | 120 mV                        | 1.2 mA                        |

# XFR Series : Product Specifications

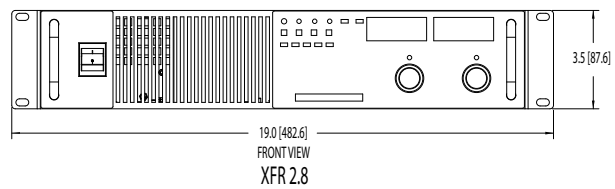
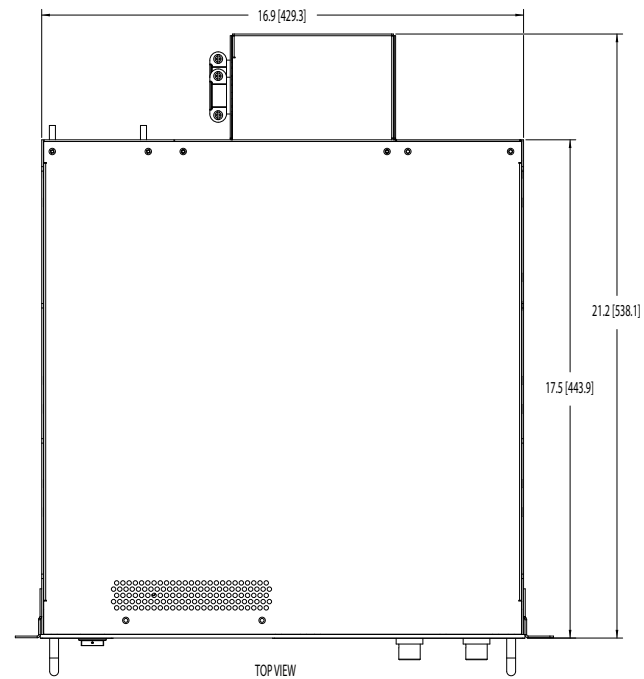
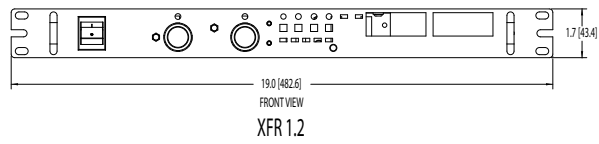
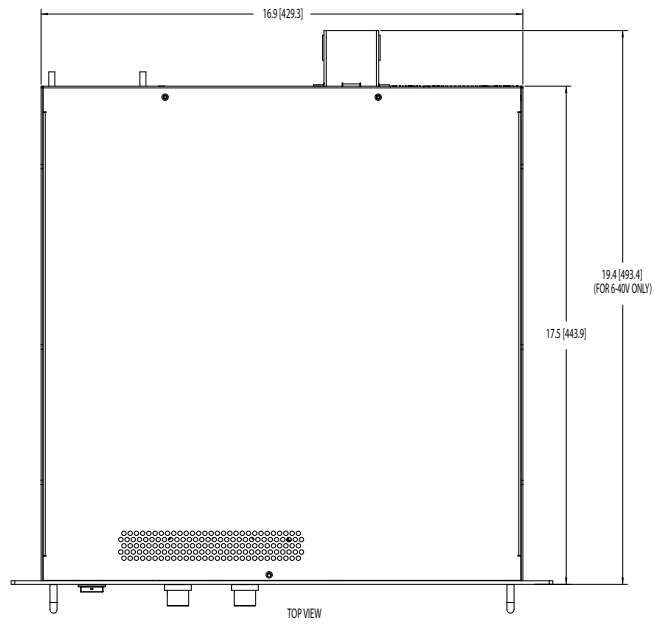
# 1.2–2.8 kW

| Model       | Program Slew Rate <sup>6</sup> |           | OVP Adjustment Range<br>(5% to 110% of Vmax) | Efficiency <sup>7</sup> |
|-------------|--------------------------------|-----------|--|-------------------------|
|             | Rise time                      | Fall time |  |                         |
| XFR 6-200   | 100 ms                         | 100 ms    | 0.3-6.6 V                                    | 75%                     |
| XFR 7.5-140 | 100 ms                         | 100 ms    | 0.375-8.25 V                                 | 78%                     |
| XFR 12-100  | 100 ms                         | 100 ms    | 0.6-13.2 V                                   | 81%                     |
| XFR 20-60   | 100 ms                         | 100 ms    | 1-22 V                                       | 81%                     |
| XFR 35-35   | 100 ms                         | 100 ms    | 1.75-38.5 V                                  | 83%                     |
| XFR 40-30   | 100 ms                         | 100 ms    | 2-44 V                                       | 83%                     |
| XFR 60-20   | 100 ms                         | 100 ms    | 3-66 V                                       | 86%                     |
| XFR 100-12  | 170 ms                         | 170 ms    | 5-110 V                                      | 84%                     |
| XFR 150-8   | 170 ms                         | 170 ms    | 7.5-165 V                                    | 84%                     |
| XFR 300-4   | 170 ms                         | 170 ms    | 15-330 V                                     | 85%                     |
| XFR 600-2   | 170 ms                         | 170 ms    | 30-660 V                                     | 85%                     |
| XFR 7.5-300 | 100 ms                         | 100 ms    | 0.375-8.25 V                                 | 80%                     |
| XFR 12-220  | 100 ms                         | 100 ms    | 0.6-13.2 V                                   | 82%                     |
| XFR 20-130  | 100 ms                         | 100 ms    | 1-22 V                                       | 85%                     |
| XFR 33-85   | 100 ms                         | 100 ms    | 1.65 - 36.6 V                                | 85%                     |
| XFR 40-70   | 100 ms                         | 100 ms    | 2-44 V                                       | 87%                     |
| XFR 60-46   | 100 ms                         | 100 ms    | 3-66 V                                       | 90%                     |
| XFR 100-28  | 170 ms                         | 170 ms    | 5-110 V                                      | 90%                     |
| XFR 150-18  | 170 ms                         | 170 ms    | 7.5-165 V                                    | 90%                     |
| XFR 300-9   | 170 ms                         | 170 ms    | 15-330 V                                     | 91%                     |
| XFR 600-4   | 170 ms                         | 100 ms    | 30-660 V                                     | 91%                     |

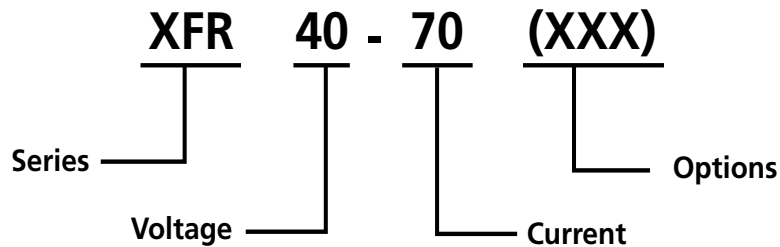
## Interface Specifications with RS-232 or GPIB Interface Installed\*

| Model       | Program Accuracy |              |          | Readback Accuracy |              |
|-------------|------------------|--------------|----------|-------------------|--------------|
|             | Voltage (mV)     | Current (mA) | OVP (mV) | Voltage (mV)      | Current (mA) |
| XFR 6-200   | 10 +0.12%        | 500 +0.12%   | 30       | 30 +0.12%         | 500 +0.1%    |
| XFR 7.5-140 | 10 +0.12%        | 500 +0.1%    | 40       | 30 +0.12%         | 500 +0.1%    |
| XFR 12-100  | 75 +0.12%        | 460 +0.1%    | 75       | 60 +0.12%         | 460 +0.1%    |
| XFR 20-60   | 75 +0.12%        | 250 +0.1%    | 100      | 75 +0.12%         | 250 +0.1%    |
| XFR 35-35   | 75 +0.3%         | 200 +0.1%    | 175      | 75 +0.3%          | 200 +0.1%    |
| XFR 40-30   | 75 +0.3%         | 150 +0.15%   | 200      | 75 +0.3%          | 150 +0.1%    |
| XFR 60-20   | 150 +0.25%       | 120 +0.1%    | 400      | 150 +0.25%        | 120 +0.1%    |
| XFR 100-12  | 150 +0.35%       | 80 +0.1%     | 500      | 150 +0.35%        | 80 +0.1%     |
| XFR 150-8   | 225 +0.35%       | 80 +0.1%     | 750      | 225 +0.35%        | 80 +0.1%     |
| XFR 300-4   | 225 +0.35%       | 80 0.1%      | 1500     | 225 +0.35%        | 80 +0.1%     |
| XFR 600-2   | 300 +0.35%       | 75 +0.1%     | 3000     | 300 +0.1%         | 75 +0.1%     |
| XFR 7.5-300 | 10 +0.12%        | 900 +0.15%   | 40       | 30 +0.12%         | 900 +0.1%    |
| XFR 12-220  | 75 +0.12%        | 750 +0.15%   | 75       | 75 +0.12%         | 750 +0.1%    |
| XFR 20-130  | 75 +0.12%        | 500 +0.15%   | 100      | 75 +0.2%          | 500 +0.1%    |
| XFR 33-85   | 75 +0.3%         | 425 +0.1%    | 175      | 75 +0.3%          | 425 +0.1%    |
| XFR 40-70   | 75 +0.3%         | 350 +0.15%   | 200      | 75 +0.3%          | 350 +0.1%    |
| XFR 60-46   | 150 +0.3%        | 250 +0.1%    | 300      | 150 +0.35%        | 250 +0.1%    |
| XFR 100-28  | 150 +0.35%       | 140 +0.15%   | 500      | 150 +0.35%        | 140 0.1%     |
| XFR 150-18  | 225 +0.35%       | 120 +0.1%    | 750      | 225 +0.35%        | 120 +0.1%    |
| XFR 300-9   | 225 +0.35%       | 80 +0.1%     | 1500     | 225 +0.35%        | 80 +0.1%     |
| XFR 600-4   | 300 +0.35%       | 80 +0.1%     | 3000     | 250 +0.35%        | 80 +0.1%     |

# XFR Series : Diagram



## Model Number Description



## XFR 2.8 Options and Accessories

|            |  |
|------------|--|
| MGA / MGB* | GPIOB / IEEE 488.1   |
| MGP        | Multi-channel GPIOB / IEEE 488.2   |
| MCA        | CANbus interface for hardware linking multiple units (used with GPIOB-M) |
| MRA        | RS-232 interface   |
| MIA        | ISOL interface card provides isolated analog control and readback        |
| M2         | 3-phase 208 Vac input  |

## XFR 1.2 Options and Accessories

|            |  |
|------------|--|
| MGA / MGB* | GPIOB / IEEE 488.1   |
| MGP        | Multi-channel GPIOB / IEEE 488.2   |
| MCA        | CANbus interface for hardware linking multiple units (used with GPIOB-M) |
| MRA        | RS-232 interface   |
| MIA        | ISOL interface card provides isolated analog control and readback        |
| RM-XFR     | 19 inch Rack Mount Kit   |

Specifications subject to change without notice.

1. Specifications indicate typical performance at 25°C ±5°C, nominal line input of 208 Vac for the 2.8 or 120 Vac for the 1.2.
2. For input voltage variation over the AC input voltage range, with constant rated load.
3. For 0-100% load variation, with constant nominal line voltage.
4. Maximum drift over 8 hours with constant line, load and temperature, after 30 minute warm-up.
5. Change in output per °C change in ambient temperature, with constant line and load.
6. Measured with stepped 0-10 V analog programming source and a resistive load.
7. Typical efficiency at nominal input voltage and rated output power.
8. Apply accuracy specifications according to the following voltage program accuracy example:  
Set a model 20-130 power supply to 10 V. The expected result will be within the range of 10 V ± 75 mV ± 0.12% of the set voltage of 10 V.

\* MGB 600V output only. MGA for output less than 600V

