

Application Note

Single phase AC Sources 61501 . 61505 or
61601 . 61605 to create a three phase output.



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Revised history table:

Version	Date	Author	Revised sections
1.0	2007	Matthijs Kuipers	Created
1.1	20-10-2017	Freek Dillingh	-Changed layout, version and style. -Added table of contents. -Changed text and order.
1.2	08-02-2018	Freek Dillingh	-Update text capitals and headings. -Update contents table.
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Introduction:

When users need a three-phase AC power source, it's allowed to assemble three 61500/61600 series AC sources to create a three-phase AC power source.

The user can set the 3-PHASE MODE on the OUTPUT functional list. When the AC source is set as MASTER it sends Synchronized signals to the SLAVE Φ for positioning the phase angle.

The SLAVE Φ also use this signal to trigger and shut down the output. To send this synchronized signal you must have a special cable. One terminal of the cable is connected to the Master Φ SYNC (in rear panel, BNC connector, see figure 1). The other terminals are connected to the /Remote-Inhibit of TTL signal (in rear panel, 9-Pin D-Type connector, see table 2), of the SLAVE Φ .

This cable can be ordered under partnumber: W38 023500.

Then users have to program the output voltage and frequency on both the MASTER and the SLAVE Φ , the user can read the measurements individually on each unit.

On CHOICE PAGE, press **3** then press **ENTER**, choose the OUTPUT functional list.

```
PAGE CHOICE = 3_
1. SETUP 2.CONF 3.OUTPUT 4. MANUAL CALI
```

```
COUPLE = AC+DC_ DEG ON= 0.0 OFF=IMMED
Vs (V/ms) = 0.000    Fs (Hz/ms) = 0.000
DCs (V/ms) = 0.000
```

Press **SHIFT**, then **▼** to change to next page.

```
3-PHASE MODE = OFF      [ OUTPUT ]
DEGREE = 0.0
```

The procedure of using three phase mode (see figure 1 for cabling):

1. Connect the N terminals of AC source outputs. (For 3-phase, Y connection).
2. Connect the cable for synchronism. (one BNC / two TTL)
3. Power on all AC sources. Keep them all in the output OFF state.
4. Set the unit with the BNC connection to 3-PHASE MODE = MASTER, DEGREE = 0. And set the other AC sources in 3-PHASE MODE = SLAVE, DEGREE = 120 or 240. Press **PAGE/EXIT** twice to MAIN PAGE. Set the voltage and frequency on each AC source. It is better for all AC sources to set the same frequency.

To change THREE PHASE MODE from OFF to SLAVE as below:

1. Move the cursor to the command line of %3-PHASE MODE=+

3-PHASE MODE = OFF_

2. Turn Dial Knob (RPG) to change the option from OFF to SLAVE, then press **ENTER**.

3-PHASE MODE = SLAVE

3. The cursor moves to the command line of %DEGREE =+automatically.

DEGREE = 0.0_

4. Press **1**, **2**, **0**, then press **ENTER**.

DEGREE = 120.0

Press **OUT/QUIT** at MASTER to start output. Press **OUT/QUIT** again to quit the output. The function of the **OUT/QUIT** button of the SLAVE is disabled in 3-phase mode.

***** NOTICE *****

1. The DEGREE setting of the MASTER is 0, and the DEGREE setting of the SLAVE is 120, it means that the SLAVE is 120-degree delayed of the MASTER.
2. The first cycle of SLAVE waveform will be distorted if the DEG ON (output on degree, see 3.7.2 of the user's manual) doesn't be set correctly. For example, if the MASTER DEG ON = 90, the DEG ON of SLAVE must be 210 ($120 + 90 = 210$). Another SLAVE must DEG ON = 330 ($240 + 90 = 330$).
3. If the DEG OFF of MASTER and SLAVE are IMMED, the MASTER phase angle will quit on zero degree, and the SLAVE will quit on 120 or 240 degree. But if users assign quit degree, for example, if the MASTER DEG OFF = 90, the DEG OFF of SLAVE must be 210 ($120 + 90 = 210$). Another SLAVE must DEG OFF = 330 ($240 + 90 = 330$).
4. The voltage setting of 3-phase output is line-to-neutral VLN for each phase. If users need the line-to-line voltage VLL, the VLN must equal to $VLL / 1.732$. The neutral has to be connected between the sources, but not to the UUT for that configuration.
5. The DEG OFF IMMED function is not supported when in three phase configuration.

***** WARNING *****

1. Only one AC source can be set as MASTER, or it may cause damage when run in 3-PHASE MODE.
2. Users cannot connect L terminals of AC source outputs together, even set the DEGREE = 0 of SLAVE.
3. For safety concern, the 3-phase mode cannot be saved as default at power-on.

The rear panel:

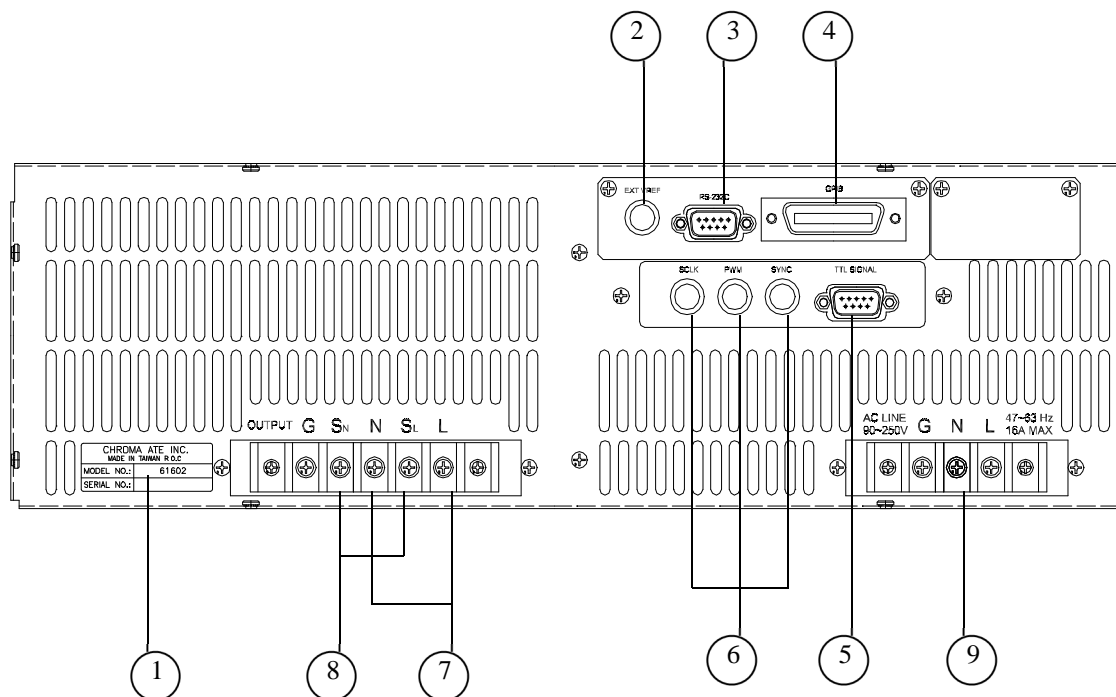


Figure 2: The Rear Panel

Table 1: The description of the rear panel:

Item	Name	Description
1	Label	The label includes model number, series number of the AC source.
2	Ext. Ref.	The BNC connector inputs control waveform amplitude from external analog signal.
3	RS-232C	The 9-pin, D-type female connector transfers control commands to and from the remote PC for remote operation.
4	GPIB Connector	A remote controller using GPIB bus is connected to the AC source through this connector for remote operation.
5	TTL SIGNAL	The 9-pin, female connector transfers control signals (fault_out, remote inhibit, and AC_ON).
6	SCLK, PWM, SYNC	The BNC connectors SCLK and PWM are for AC source parallel connectivity only. SYNC transfers a pulse signal synchronously when output changes.
7	Output Connector	This connector outputs power to the loading device.
8	Remote Sense Connector	It senses directly at the terminals of the load to eliminate any voltage drop on the connection cable. Make sure of connecting the terminal %SL+ of the remote sense connector to the terminal %L+ of the load, and the %SN+ to the %N+ of the load. Reverse polarity is not allowed.
9	Power Line in Connector	Power line input is connected to the AC source through this connector.

Table 2: 9-Pin D-type male connector:

Pin No.	Signal	Pin No.	Signal
1	GND	6	GND
2	/ Remote-Inhibit	7	GND
3	GND	8	/ FAULT-OUT
4	/ AC-ON	9	---
5	---		

/ Remote-Inhibit:

When voltage level of this pin becomes LOW, it can inhibit the output of AC source.

/ AC-ON:

When AC source output voltage, this pin will become HIGH, and it becomes LOW when quit output.

/ FAULT-OUT:

The voltage level of this pin is HIGH if AC source is in normal state. It becomes LOW when AC source is in protection state.

GPIB commands regarding the settings:

SER[IES]:STATE

Description : 3-Phase Mode Selected
 Query Syntax : SER[IES]:STATE?
 Parameters : OFF | SLAVE | MASTER
 Return Parameters : OFF | SLAVE | MASTER

Example:

Three-phase mode settings by GPIB for the C616xx series:

For master:

1 series:state master (series = 3-phase mode)
 2 instrument:degree 0

For slave:

1 series:state slave
 2 instrument:degree 120 (or 240 or other degree)