A

INSTALLATION

AND

OPERATING

MANUAL

BERTAN SERIES

602C, 603C, 605C, 606C, 612C

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SECTION I – INTRODUCTION/SPECIFICATIONS

1.0 SCOPE OF MANUAL

This manual is provided to assist the user in the installation and operation of the Bertan Series 602C, 603C, 605C, 606C and 612C modular high voltage power supplies. Statements will apply to models in all of the Series unless reference is made to specific models. For the protection of personnel and equipment, it is essential that this manual be thoroughly read prior to the installation and application of power.

1.1 PURPOSE OF EQUIPMENT

The Series 602C, 603C, 605C, 606C and 612C are families of regulated fixed output polarity modular high voltage power supplies. They provide exceptional performance in applications such as CRT's spectrometers, detectors, medical imaging, image intensifiers, E-Beam, I-Beam, medical imaging and capillary electrophoresis (HPCE) systems.

1.2 DESCRIPTION

The units are fully enclosed and designed to easily satisfy system or bench top operation. A wide range of stable output voltages, up to 30kV are available. The output voltage is controlled locally by a minimum 15-turn potentiometer. Remote analog voltage of resistance programming is also available to the user as a standard feature. All units offer a 0 to +5Vdc analog monitor output proportional to the output current.

The Series 602C, 603C and 612C require an input of 115/230Vac (switch selectable) ±10%, 50-60Hz. The Series 605C and 606C require a +28Vdc ±10% input (or +24Vdc ±10% for units equipped with +24V Option). Each unit in the Series converts the applied power to a high voltage DC output. This output voltage is highly regulated and filtered. The high voltage assembly is fully encapsulated in silicone rubber for reliable, arc-free, stable operation.

1.3 ELECTRICAL SPECIFICATIONS

The following chart lists the output High Voltage, peak-to-peak ripple and output current for all models in the Series 602C, 603C, 605C and 606C. The complete Model part number consists of the Series designation followed by the Model Suffix including either a **P** or an **N** to designate the output voltage polarity.

SUFFIX	OUTPUT VOLTAGE	RIPPLE PK to PK	MAXIMUM OUTPUT CURRENT SERIES			
			602C	603C	605C	606C
-10P, N	0 to 1KV	15 mV	15mA	30mA	9mA	30mA
-15P, N	0 to 1.5KV	15 mV	10mA	20mA	6mA	20mA
-30P, N	0 to 3KV	30mV	5mA	10mA	3mA	10mA
-50P, N	0 to 5KV	50mV	2mA	5mA	1.5mA	5mA
-100P, N	0 to 10KV	200mV	1mA	2mA	750µA	2mA
-150P, N	0 to 15KV	450mV	.6mA	1.5mA	400µA	1.5mA
-200P, N	0 to 20KV	800mV	.4mA	1mA	N.A.	1mA

SECTION I – INTRODUCTION/SPECIFICATIONS (cont'd)

The following chart lists the output High Voltage, output current and the peak-to-peak ripple for all models in the Series 612C. The complete Model part number must include the suffix, either a **P** or **N** to designate the output voltage polarity.

		OUTPUT		RIPPLE
MODEL	**SUFFIX**	**VOLTAGE**	**CURRENT**	**Pk to Pk**
612C-200	P or N	0 to 30kV	0 to 1.0mA	200mV
612C-300	P or N	0 to 30kV	0 to 0.5mA	300mV
612C-500	P or N	0 to 50kV	0 to 0.3mA	800mV

Input: 115/230Vac ±10%, 50-60Hz, .5A/.25A (Series 602C)
115/230Vac ±10%, 50-60 Hz, 1A/.5A (Series 603C & 612C)
+28Vdc ±10% @ 0.75A (Series 605C)
+28Vdc ±10% @ 2.0A (Series 606C)
+24Vdc ±10% @ 1.0A (Series 605C +24V Option only)
+24Vdc ±10% @ 2.25A (Series 606C +24V Option only)

Line Regulation: ±0.001% maximum for a ±10% input line change

Load Regulation: ±0.002% maximum for a NL to FL and FL to NL change

Temp. Coeff: 50ppm/^{o}C over the range of 0 to 50^{o}C

Stability: 0.01%/hr; 0.02%/8 hrs after ½ hour warm-up

Control: LOCAL: Internal minimum 15-turn potentiometer

REMOTE VOLTAGE: 0 to +5Vdc analog input signal is proportional to 0 to maximum rated output; (input impedance approximately 0MÙ).

REMOTE RESISTANCE: A 5kÙ potentiometer for variable control of resistor divider for fixed voltage setting.

All models provide control from 0 to 100% ±0.5%, of maximum rated output voltage.

kV Monitor: 0 to +5Vdc ±(0.1% of reading + 0.1% of maximum), via 10kÙ, for 0 to maximum rated output high voltage.

mA Monitor: 0 to +5Vdc ±(0.1% of reading + 1.0% of maximum), via 10kÙ, for 0 to maximum rated output current.

Protection: short Circuit output is limited to less than 120% of the maximum rated output current. Arc protected and self-restoring. Provision for remote TRIP input is included. Series 602C and 603C include input line fuses.

LV Connector: Input ac line power (Series 602C, 603C and 612C) via 3-terminal terminal strip. Input dc power (Series 605C and 606C) and the control and monitoring functions (all series) via 9 pin Molex 03-09-2091 connector. Mating Molex connector and pins are provided with each unit. See sections 2.7 for the appropriate terminal and pin connections.

HV Connector: SERIES 602C, 603C, 605C and 606C

MODEL	HV OUTPUT CONNECTOR	MATING HV CONNECTOR
602C -15 P,N thru -50 P,N	UG-931/U (MHV)	UG-932/U (Bertan PDB)
603C & 606C -15 P,N thru -50 P,N	KINGS 1707-1 (SHV)	1705-1 (Bertan PAE)
All 605C and all -100 P,N and –150 P,N	8101FP	8101M (Bertan PGC-008L151-000)
All –200P,N	8101FP	8101M (Bertan PGC-008L151-000)
All –300P,N	8111SFP	8111M (Bertan PGQ-008L201-000)

Only the mating connectors for the 8101FP and 8111SFP (assembled to an unshielded high voltage cable) are provided. For other HV mating connectors order separately.

SERIES 612C

MODEL	HV OUTPUT CONNECTOR	MATING HV CONNECTOR KIT
612C-200	JJA	405787
612C-300	JJA	405787
612C-500	JJB	405786

The appropriate mating connector kit is provided with each Series 612C unit. For pre-assembled high voltage cables, please consult factory.

Size & Weight:

SERIES	SIZE H" x W" x D" (mm)	WEIGHT lbs (kg)
602C	5.03 x 3.06 x 8.66 (125 x 78 x 220)	6.75 (3.1)
603C	5.00 x 5.50 x 8.50 (127 x 140 x 216)	8.0 (3.64)
605C	5.04 x 2.75 x 4.75 (128 x 70 140 x 114)	3.2 (1.45)
606C	5.00 x 5.50 x 4.50 (127 x 140 x 114)	3.5 (1.6)
612C	4.88 x 8.38 x 9.75 (124 x 213 x 248)	9 (4.1)

SECTION II – OPERATION

CAUTION: THIS UNIT CAN STORE HAZARDOUS VOLTAGE! COMPLETELY DISCHARGE THE HIGH VOLTAGE TO GROUND BEFORE ATTEMPTING REMOVAL OF THE HIGH VOLTAGE CABLE.

2.1 INSTALLATION

All power supplies can be mounted in any position using the tapped holes in the base plate. The mounting screws should extend no more than ¼" into the unit. Series 602C and 605C require #8-32 mounting screws. Series 603C, 606C, and 612C require #10-32 mounting screws.

2.2 INPUT POWER

Input power is applied via the 3-terminal terminal strip for the Series 602C, 603C, and 612C or via the 9-pin connector for the Series 605C and 606C. The terminal or pin connections are as listed in Section 2.7.

CAUTION: APPLICATION OF INPUT POWER CAN IMMEDIATELY PRODUCE A HIGH VOLTAGE OUTPUT!

2.3 HIGH VOLTAGE CONTROL

There are three modes of controlling the high voltage. The use can select mode by making appropriate connections via the 9-pin Molex connector. All modes provide high voltage control from 0 to 100% (± 0.5%).

2.3.1 INTERNAL POTENTIOMETER CONTROL

See Section 2.7 for hook-up information. This will allow control of the high voltage output by means of the multi-turn potentiometer accessible via a hole in the cover.

2.3.2 EXTERNAL POTENTIOIMETER CONTROL

See Section 2.7 for hook-up information. Connecting an external potentiometer (recommended value of 5kΩ) will control the high voltage output independently of the internal potentiometer setting.

2.3.3 EXTERNAL VOLTAGE CONTROL

See Section 2.7 for hook-up information. The output high voltage can be controlled by a 0 to +5Vdc analog signal.

2.4 HIGH VOLTAGE MONITOR

See Section 2.7 for hook-up information. A 0 to +5Vdc analog signal which is proportional to the output high voltage. The monitor has a series impedance of 10kΩ.

2.5 OUTPUT CURRENT MONITOR

See Section 2.7 for hook-up information. A 0 to +5Vdc analog signal which is proportional to the output current. The monitor has a series impedance of 10kΩ.

2.6 TRIP UNIT

See Section 2.7 for hook-up information. Provides the user with a means of remote turn ON/OFF. This input requires a contact closure to ground to turn off the high voltage. An NPN open collector transistor logic can also be employed. When no connection is made to this input the high voltage is enabled.

2.7 INPUT/CONTROL/MONITOR CONNECTIONS

INPUT POWER CONNECTIONS
SERIES 602C/603C/612C ONLY

TERMINAL	FUNCTION
1	115/230Vac Input
2	Neutral
3	Ground

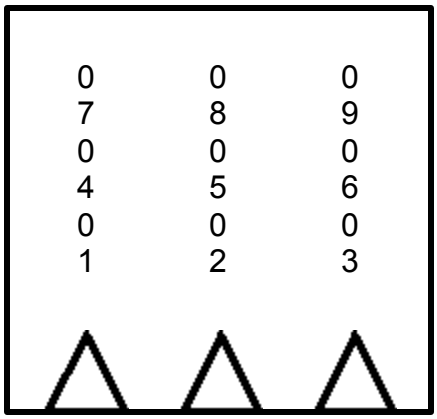
INPUT POWER CONNECTIONS
SERIES 605C/606C ONLY

P2/PIN#	FUNCTION
1	Input Power Control
2	+Vcc Input

CONTROL AND
MONITORING CONNECTIONS
ALL MODELS

P2/PIN#	FUNCTION
3	Ground
4	Program Input
5	+5Vdc Reference
6	kV Monitor
7	Current Monitor
8	Trip (Short to Gnd)
9	Internal Program

PIN LAYOUT
INPUT/CONTROL/MONITOR
CONNECTOR (P2)



Note: To obtain local control using the internal potentiometer accessible at the top of the unit, jumper P2 pin 4 to pin 9.

For remote potentiometer control connect the remote potentiometer as follows:

CW terminal to P2 pin 5
CCW terminal to P2 pin 3
Wiper terminal to P2 pin 4

For remote 0 to +5V voltage programming apply the input program voltage to P2 pin 4.

For remote TRIP connect P2 pin 8 to P2 pin 3

SECTION III PROGRAMMING OPTIONS

3.1 GENERAL

To provide additional flexibility and compatibility with earlier models, provision has been included to allow voltage programming of all models with a 0 to –5 Volt programming input. There are four different jumper-selectable modes for programming. The jumpers for selecting the required operating mode are located on PCB100 (the large PCB), easily accessible upon removal of the cover. Jumper locations are shown below in Table III-1.

The four modes are described below. The first three modes apply to all Series 602C, 603C, 605C, 606C and 612C units. The last mode applies only to the Series 612C and is included only with Series 612C units ordered with the –5VPRO option.

3.2 STANDARD MODE

The unit is shipped in this configuration and operation is as described in the previous sections of this instruction manual. The unit can be controlled using the internal pot or programmed with a remote 0 to +5 Volt signal or controlled with a remote potentiometer.

3.3 -5 VOLT PROGRAMMING (for 0 to 100% output voltage) MODE

To achieve this operation the jumpers on PCB100 must be configured as shown in the chart below. In this mode the programming signal is applied to P2 pin 4, same as for Standard Mode, only now a 0 to –5 Volt programming input is required to achieve 0 to 100% output voltage programming. No jumpers should be attached to P2, the external connector. In this mode there is no internal control, the internal potentiometer is bypassed.

3.4 -5 VOLT PROGRAMMING (for 0 to 103% output voltage) MODE:

To achieve this operation the jumpers on PCB100 must be configured as shown in the chart below. In this mode the programming signal is applied to P2 pin 4, same as for Standard Mode. No jumpers should be attached to P2, the external connector.

In this mode the internal potentiometer is used to control the maximum programmed output voltage at –5 Volt programming input. With the potentiometer fully clockwise, the output will be 0 to 103% of maximum for a 0 to –5 Volt input. With the potentiometer turned up approximately half way, a 0 to –5 Volt input will produce a 0 to approximately 50% of maximum output voltage.

This mode is included to provide exact compatibility with some previous units. It also provides the user with a controllable upper limit on the programmed output for an input of –5 Volts.

3.5 SERIES 612C –5 VOLT PROGRAMMING MODE

Series 612C units ordered with the –5VPRO (-5 Volt Programming) option, include an extra 5 pin Winchester connector (J3). The connector contains additional monitor outputs and a 0 to –5 Volt programming input. This option provides compatibility with earlier Series 612C models when used with –5 Volt programming. The mating connector for J3 is included and J3 connections are shown below in Table III-2.

In this mode the programming signal is applied to J3 pin A. A 0 to –5Volt programming input is required to achieve 0 to 100% output voltage programming. No jumpers should be attached to P2, the external connector. In this mode there is no internal control, the internal potentiometer is bypassed.

TABLE III-1 PCB 100 JUMPER POSITIONS

STANDARD MODE:
Jumper pins 1 to 3, pins 5 to 7

3.3 -5 VOLT PROGRAMMING (for 0 to 100% output voltage) MODE:
Jumper pins 1 to 2, pins 3 to 4

3.4 -5 VOLT PROGRAMMING (for 0 to 103% output voltage) MODE:
Jumper pins 1 to 2, pins 3 to 5, and pins 6 to 8

3.5 SERIES 612C –5 VOLT PROGRAMMING MODE:
Jumper pins 3 to 5, pins 4 to 6, and pins 7 to 8

TABLE III-2 J3 PIN CONNECTIONS
(Series 612C Option –5VPRO only)

PIN A: 0 to –5Volt programming input
PIN B: NC
PIN D: Output voltage monitor (0 to +5V for 0 to maximum HV output)
PIN E: GND
PIN H: Output current monitor (0 to +5V for 0 to maximum current out)

SECTION IV – CIRCUIT DESCRIPTION

4.1 FUNCTIONAL DESCRIPTION

The functional schematic and block diagram of a Series 602C, 603C, 605C, 606C, and 612C units are shown in the following pages. The 602C, 603C, and 612C employ a standard step down transformer to obtain a nominal +28Vdc from the input ac power. The Series 605C and 606C obtain +28Vdc (+24Vdc for +24V Option models) from the input ac power. The circuit converts the +Vdc low voltage input DC power to a high voltage DC output. This output voltage is highly regulated and filtered and can be varied either by the local potentiometer control or through the REMOTE PROGRAM input.

An oscillator determines the frequency (approximately 20kHz) at which all amplification, high voltage transformation, rectification and filtering occurs. The amplification is a function of a control voltage which performs the function of control and regulation. A sample of the output voltage is compared against a reference voltage in the sensing circuit. The sensing circuit generates the control voltage to set and maintain a fixed high voltage output.

The encapsulated high voltage assembly includes a high voltage power transformer, rectifier or multiplier circuits, ripple filter and sensing circuits. These are all critical, custom designed and encapsulated components.

SECTION V – MAINTENANCE

5.1 GENERAL

The high voltage power supply should not require any maintenance or calibration. It is designed for reliable, trouble free operation. If any question should arise, contact the Bertan Customer Service Department for assistance or return authorization. Although adequate information is provided in the schematic included with this manual, it is suggested that the unit be returned to the factory is service should become necessary.

The power supply can be returned to the factory for annual calibration and certification to its original specification. For traceability, a certificate will be issued, indentifying the serial number of the unit calibrated and all test equipment used to perform the calibration. All measurements are traceable to the National Institute of Standards and Technology (N.I.S.T.). Contact the factory for additional details.

5.2 CLEANING

Cleaning of the power supply should ***only*** be performed with the supply disconnected from the ac power source. A soft cloth moistened with conventional ammonia-based cleaning agents will suffice for all exposed surfaces. The exposed shell of the HV connector should be cleaned with isopropyl alcohol.

If the supply is operated in a dusty environment, an accumulation of dust/debris may build-up inside the unit which may cause noisy operation (i.e., “ticking” or minor crackling) in the area of the HV cabling on the 10kV through 30kV models. The safest way to remove such debris is with compressed air. Ensure that no dust/debris is left behind in the insulative medium of the HV output connector after this cleaning operation. Such dust may be removed with a cotton swab moistened with isopropyl alcohol.

Full-sized schematics are available at no charge. Please call Bertan at 1 (800) 966-2776.