



Princeton Instruments

IIC-200 Image Intensifier Controller


ROPER SCIENTIFIC™
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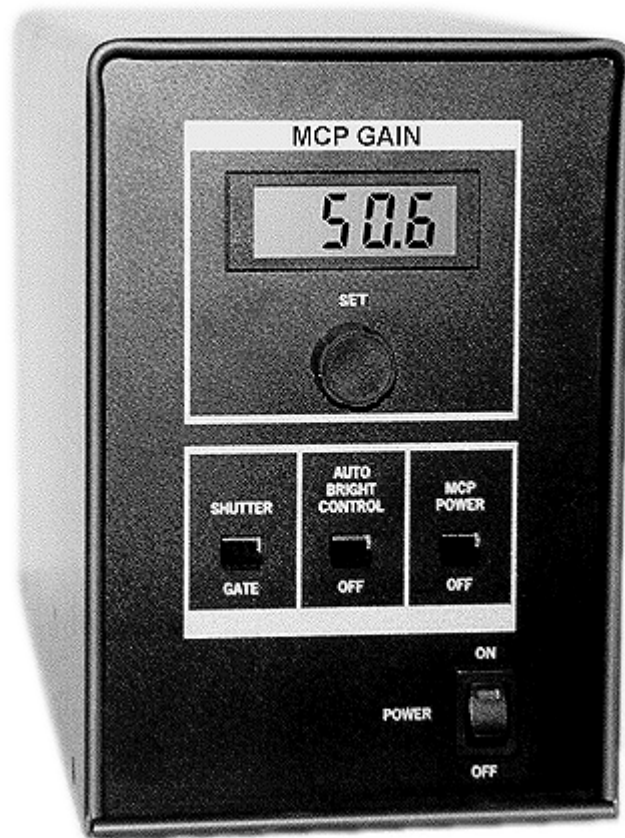
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Model IIC-200 Image Intensifier Controller

*Figure 1.
Model IIC-200
Image
Intensifier
Controller*



Introduction

The IIC-200 is a stand-alone image intensifier controller. It supplies high-voltage DC bias for Princeton Instruments image intensifiers plus circuitry to facilitate gating. Gating pulses are provided by a Princeton Instruments high voltage pulser.

The IIC-200 allows front-panel control of the MCP gain (MCP voltage). In applications where the average light level varies significantly, the automatic brightness control mode can be switched on. In this mode, the MCP gain varies inversely with the signal level, enhancing the input dynamic range while restricting the output dynamic range, and facilitating focusing. An alarm feature automatically shuts down intensifier operation in case of excessive phosphor current.

The IIC-200 allows both Shutter and Gated modes of operation. Gating pulses can range from 5 nsec to DC. Longer gate experiments can also use the 5 volt logic electronic shutter control.

Dangers and Warnings

DANGERS

Voltages inside the IIC-200 may exceed 10,000 volts. To avoid possible hazard to personnel, use the instrument only with the proper connectors and cables and only for the purposes for which it is designed, i.e. the operation of image intensifier tubes which are contained in proper housings and equipped with compatible connectors. Adequate precautions must be taken to prevent persons from making contact with the output of the IIC-200.

Never plug the AC cord into an outlet which is not properly grounded. Never attempt to operate the unit without its covers in place.

WARNINGS

Never operate the unit with the high voltage cable disconnected. The high voltage connectors are designed to seal out air to avoid arcing. An open high voltage connector is a danger to personnel and can cause damage to the equipment. Connections should be made before power is turned on.

Before disconnecting any cables, turn the power off and wait at least 5 minutes for voltages to decay to safe levels.

The IIC-200 chassis uses a three wire power cord for connection to the power source and to a protective ground. The exposed parts of the instrument, including the BNC shields, are connected to the outlet ground to protect against electrical shock. Always use an outlet which has a properly connected protective ground. Never make connections to other instruments which might have voltages on BNC shields. Disconnecting the protective earth terminal, inside or outside the chassis, or tampering with its operation may render the IIC-200 dangerous and is prohibited.

The high-voltage Gate In connector (BNC with Gen II intensifier, SHV with Gen IV intensifier) is located next to the Shutter In BNC connector on the back panel. The Shutter In BNC connector is the input for a TTL (5 V) logic level signal and should never be connected to a high-voltage gate pulse or damage could occur. Always take care not to confuse these inputs.

During manufacture, a Model IIC-200 is configured for operation with a Gen II Intensifier or with a Gen IV Intensifier, **but not for operation with both types**. The two types are **not** interchangeable. Units configured for operation with a Gen IV Intensifier will ordinarily have a green identification label on the back panel. Units configured for operation with a Gen II Intensifier will have a blue label. Your detector may have corresponding color-coded labeling. *Check with the factory if you are in doubt.* Using the wrong IIC-200 type with your intensifier could damage the intensifier. Damage due to such misuse is **not** covered by the Warranty.

Note: The Model IIC-200 has automatic circuitry to help prevent damage. However, it is far better not to place an expensive intensifier at risk than to depend on the protection circuitry.

Features

- Independently variable MCP power supply, independent of phosphor voltage.
- Automatic alarm and shutdown in case of excessive phosphor current.
- Automatic brightness control switch for ease of focus.
- Gate input for gating between 5 nsec and DC, electronic shuttering input for long gate times or CW operation.
- Compatibility with Princeton Instruments gate pulsers and controllers.

Specifications

- **MCP power supply:** 500 to 1000 volts, 100 μ A maximum. *Contact the factory for higher current applications up to 500 μ A.*
- **Intensifier bias levels (Standard Configuration):**
 - Phosphor:** 0 volts, i.e. grounded phosphor.
 - MCP-Out:** -5500 volts typical, Gen II
 - MCP-In:** -6000 to -6500 volts typical, Gen II
- **Photocathode to MCP-In voltage:** -180 volts in CW mode, +40 volts in gate mode, Gen II. Gen IV versions have voltages appropriate to Gen IV intensifiers.
- **Gate pulse**
 - Gen II Intensifier:** -180 to -220 V, 5 nsec to 1 msec, externally supplied. Princeton Instruments PG-200 Pulser recommended.
 - Gen IV Intensifier:** Approximately -1000 V, 12 nsec to 1 msec, externally supplied. BNC Corp. Model 6040 Pulse Generator with Model 310H plug-in module recommended (12 ns to 10 μ s).
- **Shutter pulse:** 5 volt TTL input. Logic 1 turns the Intensifier on in CW mode. Logic 0 (0 V) turns it off. Used to achieve gate times longer than the 80 ms delay + gate width obtainable with a PG-200. Minimum TTL 1 pulse width to turn intensifier on is 50 μ sec.
- **Automatic Brightness Control:** Gain reduction of 16 typical under maximum incident light.
- **Phosphor over-current shutdown:** 30 nA typical. Over-current condition sounds audio beeper.
- **Audio beeper:** ~1 kHz, cycles on/off at rate dependent on overload.

Front Panel Features

MCP GAIN: This adjustment is used to control the gain of the MCP by controlling the voltage across it. Display units are arbitrary.

SHUTTER/GATE: This switch selects between Gate mode or Shutter mode. In Gate mode, the intensifier is normally off and a high-voltage gate pulse is needed to turn it on. In the Shutter mode, the intensifier is normally on, and a TTL logic low (0 V) must be applied to the back panel Shutter In BNC connector to turn the intensifier off. The Shutter Monitor output provided by Princeton Instruments CCD Controllers can be applied to turn off the intensifier during readout.

AUTO BRIGHT CONTROL ON/OFF: This switch turns the automatic brightness control feature on or off. Brightness control reduces the MCP gain when exposed to high light levels. This compresses the output dynamic range to keep signal levels on screen during set-up.

Note: When making quantitative measurements, **AUTO BRIGHT** should be **OFF**.

MCP POWER ON/OFF: This switch turns the intensifier voltages on or off while chassis power remains on.

POWER ON/OFF: This switch turns the IIC-200 chassis power on or off.

Back Panel Features

GATE IN: This is the input for high voltage (-200 V) gate pulses used to turn on the intensifier. In units intended for use with a Gen II intensifier, **GATE IN** is a BNC connector. In units supplied for operation with a Gen IV Intensifier, which requires a gate pulse of approximately -1000 V, **GATE IN** is a type SHV connector. A high-voltage pulser is required in both cases.

SHUTTER IN BNC: This TTL (5 V) input is used to synchronize the intensifier with the CCD exposure time or to hold the intensifier on in Shutter mode operation.

WARNING

If the front-panel Shutter/Gate switch is set to **SHUTTER**, the intensifier will be biased on if the Shutter In connector is floating, or if +5 V is applied. As a result, the intensifier is particularly vulnerable to overload damage in this mode. If the switch is set to **GATE**, the Shutter In connector is inactive and the intensifier can only be biased on for the duration of high-voltage gate pulses applied to the Gate In connector.

INTENSIFIER H.V.P.S: This connector is used to supply High Voltage DC power to the intensifier through the cable supplied by Roper Scientific. The high voltage cable must always be connected *at both ends* before turning the power on.

POWER MODULE: This module contains the line-cord socket, line fuse and line voltage selection assembly. The power and fuse requirements are printed on the panel above the power module.

Figure 2.
Model IIC-200
back panel



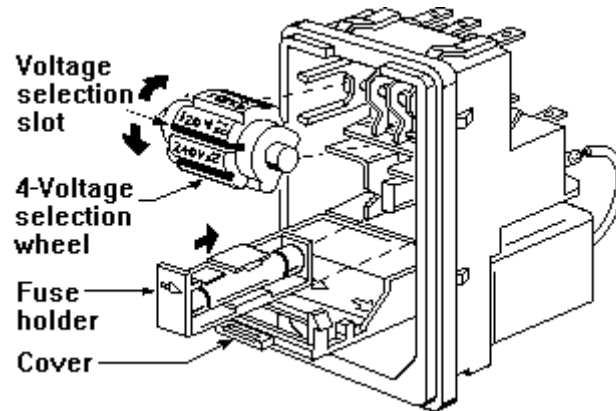
The plug on the line cord supplied with the system should be compatible with the line-voltage outlets in common use in the region to which the system is shipped. If the line cord plug should prove to be incompatible, a compatible plug should be installed, taking care to maintain the proper polarity to protect the equipment and assure user safety.

There is provision for changing the selected line voltage and for changing the fuse. The line fuse value depends on the line voltage as indicated above the Power Module. Figure 3 illustrates the fuse access and voltage selection mechanisms. The Power Module is designed to accept one $\frac{1}{4} \times 1\text{-}1/8$ " fuse or two 5×20 mm fuses.

Line Voltage Selection

- ◆ If the IIC-200 has been in operation, turn it off and wait at least 5 minutes for voltages to decay to safe levels.
- ◆ Disconnect the power cord.
- ◆ Insert a small screwdriver under the cover tab at the top of the Power Module.
- ◆ Gently pry open the voltage selector cover and rotate the voltage selector until the setting for the local line voltage is facing you.
- ◆ Check that the appropriate fuse(s) have been installed. (1/2 Ampere T time delay for 100/120 V AC; 1/4 Ampere, T time delay for 220/240 V AC).
- ◆ Close the cover *making sure the desired voltage setting appears in the window*. Normally, the correct voltage setting and line fuses for your area will be installed at the factory, provided that information was specified in the order.

Figure 3.
Power Module
line voltage
selection and
fuse installation



Hardware Overview

The IIC-200 consists of a printed circuit board and a modular high voltage supply which are mounted in a stand-alone chassis.

The IIC-200 contains circuitry for the following functions:

- A variable high voltage power supply for the MCP voltage. The MCP voltage is a linear function of the voltage supplied by the MCP Gain potentiometer.
- Upper and lower limit circuits for the MCP voltage (normally set to -500 V and -800 V respectively for Gen II).

Note: When the image intensifier and IIC-200 are purchased from Roper Scientific as part of the same order, the upper limit circuit will be set for the maximum limit of the intensifier. The upper limit circuit also provides a slow turn-on during power-up.

- High-voltage adjustment circuit for the voltage between MCP-Out and the Phosphor (normally set for -5500 V for Gen II Intensifiers).
- Alarm and shutdown circuit to shut down the high voltage and bring the MCP voltage to almost zero if an over-current condition exists due to excessive light on the Photocathode. This circuit additionally actuates an audible alarm if an over-current condition occurs. The circuit automatically resets and retries after about 0.5 seconds. Thus it will not prevent intensifier damage if excessive light is allowed to continuously fall on the intensifier.
- Automatic Brightness Control circuit to reduce the MCP voltage in response to increasing light intensity on the Photocathode. This can be useful in focusing. When properly interfaced to a Princeton Instruments CCD Controller, the Brightness Control circuit uses a sample/hold to sample the phosphor current during CCD exposure and hold it between exposures. The sample/hold is inactive in the Gate mode. The automatic Brightness Control function should be turned off for normal operation, since the response isn't linear (and may not even be constant) when it is used.

- Shutter circuitry which allows an electrically isolated logic signal to control the voltage between the Photocathode and MCP In. This allows long gate times or CW operation.

Operation

- ◆ Review the Danger and Warning notices on page 6 before operating the IIC-200.
- ◆ Set the IIC-200 Power switch to **OFF** and wait 5 minutes.

CAUTION

The high voltage cable should be handled with care. Dropping the cable, banging the connectors, twisting the wires or applying excessive force when tightening may damage the pins, resulting in a poor or intermittent connection.

Connections with a Gen II Intensifier

- ◆ Connect one end of the high-voltage cable supplied by Roper Scientific to the high-voltage connector on the image intensifier. If you have purchased more than one image intensifier, make sure you are using the cable supplied with that particular intensifier. The connectors are keyed and must be properly oriented. Push the cable connector into the receptacle and continue to turn the threaded ring clockwise until it is tight (10 inch-lbs maximum torque).

Note: Two versions of the 6-pin high voltage cable have been shipped by Roper Scientific. Early high-voltage cables have a white housing. Later ones have a black housing and a white stripe. These cables are wired differently. The IIC-200 is compatible with the newer style cables only. For more information, see *The High Voltage Cable* on page 13.

- ◆ Connect the opposite end of the cable to the high-voltage output connector of the IIC-200 using the same procedure.

Gated Operation

- ◆ For gating, set the **Shutter/Gate** switch to **Gate**.
- ◆ Connect a cable from the output of the pulser to the **Gate In** BNC connector. For Gen II units, the mating connector must be a BNC type.

Shutter Mode Operation

- ◆ For shuttering, set the **Shutter/Gate** switch to **Shutter**.
- ◆ Connect a BNC cable to the IIC-200 **Shutter In** BNC connector. Connect the other end to the Controller's TTL SHUTTER OUT BNC connector (may also be named SHUTTER or SHUTTER MONITOR, depending on the controller model).

WARNING

Unlike Princeton Instruments integrated ICCD detectors, in Shutter mode operation, if the Shutter In BNC on the IIC-200 is allowed to float, the intensifier will be **On Continuously**. Overexposing the image intensifier at any time when the intensifier is turned on can result in permanent damage to the image intensifier.

Connections with a Gen IV Intensifier

- ◆ Connect one end of the high-voltage cable supplied by Roper Scientific to the high-voltage connector on the image intensifier. If you have purchased more than one image intensifier, make sure you are using the cable supplied with this intensifier. The connectors are keyed and must be properly oriented. Push the cable connector into the receptacle and continue to turn the threaded ring clockwise until it is tight (10 inch-lbs maximum torque). Connect the opposite end of the cable to the high-voltage output connector of the IIC-200 using the same procedure.

Note: Two versions of the 6-pin high voltage cable have been shipped by Roper Scientific. Early high-voltage cables have a white housing. Later ones have a black housing and a white stripe. These cables are wired differently. The IIC-200 is compatible with the newer style cables only. For more information, see *The High Voltage Cable* on page 13.

Gated Operation

- ◆ For gating, set the **Shutter/Gate** switch to **Gate**.
- ◆ Connect a SHV Tee (A SHV connector in the shape of the letter “T”) to the to the **Gate In** SHV connector of the IIC-200.
- ◆ Be sure the Pulser power is OFF.
- ◆ Connect a cable from one side of the SHV Tee to the HV output of a Berkeley Nucleonics Corp. Model 6040 Universal Pulse Generator equipped with a Model 310 plug-in Electrical Module. This cable should be no more than 1 m long. A type N-to-SHV adapter will be required to make the connection. This adapter is provided if the 6040 is ordered from Roper Scientific.

Note: Although SHV and BNC connectors are superficially similar, they are dimensionally different and incompatible. The SHV connector is designed for high-voltage applications.

- ◆ Connect a second cable from the other side of the SHV “Tee” to the high-power 50 Ω terminator. This cable should also be no longer than 1 m, although the requirement is less stringent than for the cable connecting the pulser output to the “Tee.”

CW or Shutter Operation

WARNING

To prevent damage to the IIC-200 circuitry, the Berkeley Nucleonics Corp. Pulser should be disconnected for Shutter mode operation.

- ◆ For shuttering, set the **Shutter/Gate** switch to **Shutter**.
- ◆ Connect a BNC cable to the IIC-200 **Shutter In** BNC connector. Connect the other end to the Controller’s TTL SHUTTER OUT BNC connector (may also be named SHUTTER or SHUTTER MONITOR, depending on the controller model) .

Power Up Steps

- ◆ Make sure the front-panel MCP Power switch is Off. Adjust MCP Gain to minimum and turn on the chassis power.

Note: As long as the image intensifier and IIC-200 are purchased from Roper Scientific as part of the same order, the upper limit circuit will be set for the maximum safe limit of the intensifier. In this case, the maximum voltage may be less than -1000 V.

- ◆ After the MCP voltage has been properly set, set the MCP Power switch on and slowly bring up the MCP voltage to the desired setting. High voltage will now be on the intensifier. It is normal for the alarm beeper to sound when power is first applied. However, if it continues to sound, set the MCP power switch off and determine the cause (e.g. switch set to Shutter instead of Gate or excessive light on the Photocathode).

CAUTION

If the intensifier is operated at excessive MCP voltage, ion feedback may occur. If allowed to continue this condition may damage the intensifier. Therefore, be sure to monitor the light output from the intensifier (usually done by reading the CCD or other readout device) when increasing the MCP voltage setting. A sudden increase in output light, especially if not related to light on the input, is evidence of ion feedback. As intensifier tubes age, they sometimes become more susceptible to ion feedback, so it is advisable to check rather than to rely entirely on the factory limit setting.

- ◆ For initial set-up, the Brightness Control feature can be used. Set the Auto Bright Control switch to the on position. This will reduce MCP voltage (and hence gain) in proportion to light level, so a greater range of input light can be tolerated. The alarm is still functional in this mode, and the intensifier voltage will still be shut down in case of excessive exposure levels. Be sure to set the Auto Bright Control switch off before taking data, or the intensifier will be nonlinear.

The High Voltage Cable

Two versions of the 6-pin high voltage cable have been shipped by Roper Scientific. Early high-voltage cables have a white housing. Later ones have a black housing and a white stripe. These cables are wired differently. The IIC-200 is compatible with the newer style cables only.

If you have an older style Princeton Instruments image intensifier unit, originally supplied with the old-style cable, it will be necessary to return intensifier back to Roper Scientific to be updated before it can be used with the IIC-200. Intensifiers for use with black cables always have 6 conductors on the intensifier connector.

WARNING

The cable with the white housing is unsafe if not used strictly according to instructions.

If a white cable is connected at one end only to an IIC-200 and the IIC-200 is turned on, arcing at the open end of the cable is likely and could cause painful and possibly hazardous electrical shock. Roper Scientific can update any white cable and 4 conductor image intensifier combination to the black-cable 6-conductor combination. Roper

Scientific highly recommends updating old units at the user's earliest convenience. Contact the factory for details.

Connecting the wrong cable at both ends can result in non-functioning of the image intensifier. If you suspect that you may be using the wrong cable for your intensifier, contact the factory or your local sales representative. If you have only purchased a single image intensifier and IIC-200 combination, the correct cable was shipped with your system.

Warranty & Service

Warranty

This equipment is warranted to be free from defects of material and workmanship. It is sold subject to the mutual agreement that the liability of Roper Scientific is limited to replacing defective parts and/or repairing malfunctioning equipment at its factory, provided the equipment is returned, transportation prepaid, within twelve (12) months of its factory ship date.

The purchaser agrees that Roper Scientific shall assume no liability for consequential damages resulting from its use or from packaging of shipments returned to the factory.

Components which are damaged by misuse are not warranted. Units which have been modified by a customer are not warranted.

UV coatings are not covered by this warranty.

Equipment Repairs

It is recommended that units requiring service in the United States be returned to the factory located in Trenton, New Jersey. Before instrumentation is returned for service, please consult a service engineer at the factory. In many cases, the problem may be cleared up over the telephone.

If the unit needs to be returned, the service engineer will ask for a detailed explanation of the problems encountered and a purchase order to cover any charges. You will then receive a Returned Materials Authorization (RMA) number. Place this number on the package so the returned equipment can be easily identified when received at the factory. You must also include with the equipment a completed RMA form explaining the symptoms or problems encountered. Without this document, repair turnaround time will be considerably longer.

If the unit is under warranty, the customer is only responsible for the transportation and insurance charges to Roper Scientific. Roper Scientific is responsible for the return transportation charges. If the unit is out of warranty, the customer is responsible for all transportation charges (including insurance and duty fees, when applicable) as well as all charges incurred to perform the repairs. In this case, the customer can decide the insurance value.

International customers should contact your local manufacturers representative or distributor for repair information. *See next page for contact information.*

Contact Information

Roper Scientific's manufacturing facility is located at the following address:

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3660 Quakerbridge Road
Trenton, NJ 08619 (USA)

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Fax: 609-587-1970

Tech Support E-mail: techsupport@roperscientific.com

For technical support and service outside the United States, see our web page at www.roperscientific.com. An up-to-date list of addresses, telephone numbers, and e-mail addresses of Roper Scientific's overseas offices and representatives is maintained on the web page.

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