## **FET-4** Timer

Part 108 001A

Nordson.

NORDSON CORPORATION • AMHERST, OHIO • USA

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## SECTION 1 SAFETY SUMMARY

#### Introduction

Here you will find safety guidelines for the use of Nordson equipment. These guidelines apply to anyone working with Nordson equipment, including operations and service personnel. They are repeated throughout this manual, along with specific warnings and cautions not included in this section.

Failure to follow these recommendations may result in personal injury from burns or electrocution and/or cause equipment and property damage.

It is also important to understand that these warnings and cautions are not exhaustive but are developed to assist the installer and operator in safely installing or operating the equipment. The Nordson Corporation could not possibly know, evaluate, and advise of all the conceivable ways in which installation or service might be done and of the possible hazards related to each. Anyone who undertakes to install or service this equipment must ensure that the method to be used is safe and conforms to all local, state, and federal code requirements.

#### **Explanation of Terms and Symbols**

The following symbols are used in Nordson publications to alert the reader to potential physical harm or equipment damage:



WARNING: General warning. Failure to observe may result in personal injury or death from fire or explosion.



WARNING: Risk of electrical shock. Failure to observe may result in personal injury or death.



## NOTE: Important information. Failure to observe may result in property damage

#### **Electrical Installation**

A protective electrical ground connection to a reliable earth ground is essential for safe operation. Upon loss of the protective electrical ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulated) can render an electric shock.

A disconnect switch with lockout capability should be provided in the line ahead of the equipment.

Wiring used to supply electrical power shall be of sufficient size and insulation to accommodate the product power and temperature requirements.

To avoid fire hazard, use only the fuse of correct type, voltage rating, and current rating as specified in the parts list for your product.

#### Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

#### Do Not Remove Covers, Panels, or Safety Guards

To avoid personal injury, do not operate the product without the covers, panels, and safety guards properly installed.

#### **Do Not Service Alone**

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

#### **Use Care When Servicing**

Refer all servicing to qualified personnel.

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect, lock out, and tag out external electrical power before removing protective panels or replacing electrical components.

Remove all jewelry, rings, watches, etc. before working in equipment.

While performing electrical tests, work on a rubber mat if possible. Do not work on equipment if standing water is present. Avoid working in a high-humidity atmosphere. Cover exposed terminals and work area with rubber sheeting to avoid accidental contact while the power is on. As much damage can result from reflex response as from contact with the power source.

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## SECTION 2 EQUIPMENT FAMILIARIZATION

#### Introduction

The FET-4 provides high-speed actuation and precise delay/duration control of the device to be timed. Incorporating the latest advances in electronic engineering, the FET-4 provides unsurpassed accuracy, repeatability, and versatility. Modular design, logical control layout, and operational and diagnostic Light Emitting Diodes (LED's) provide simple operation and fast, easy troubleshooting.

The FET-4 Timer consists of a power supply module, a main frame for plug-in circuit boards, and a sealed, splash-resistant enclosure with locking door. All connections are made at the rear of the unit via locking, quick-disconnect fittings. The power supply section provides regulated and filtered DC voltage to the mainframe board and its attendant circuits. Input voltage selector switches enable the unit to operate on standard electrical supplies worldwide.



Figure 1 - FET-4 Timer Front View

<b>←_`</b> ¶	LIGHT SOURCE
₽≁	RECEIVER
₽← 2 ←;┓	LIGHT SOURCE AND RECEIVER #2
╔╪╾╢┓	BREAK-LIGHT
╔┿╍┓	MAKE-LIGHT
<b>P</b>	EXTRUSION (TEST)
Q	DELAY
Q	DURATION
-	PUSHBUTTON ENGAGED
-	PUSHBUTTON DISENGAGED
<b></b> 1	ON WHEN PUSHBUTTON ENGAGED
	OFF WHEN PUSHBUTTON DISENGAGED
<b>I</b> 1	TIMER MODULE #1
▼ 1	DRIVER MODULE #1

Table 1 - Key to Symbols on Cabinet and Modules

The standard FET-4 Timer is equipped to handle one device. One Inductive Proximity Sensor is provided to trigger the timer as an object passes it. An Expansion Kit is available to upgrade the FET-4 to handle two devices, and an additional Proximity Sensor can be added for two device applications which are used on separate lines.



Figure 2 - FET-4 Timer Back View

#### Modules

The FET-4 Timer has four separate modules: the Sensor Module, the Timer Module, the Counter Module, and the E. G. Driver Module. Table 1 has the key to the symbols used on the cabinet and on the faceplates of the modules.

#### **Sensor Module**

The Sensor Module has two independent sensing channels. The module can receive and discriminate between signals from two individual sensors. This provides the capability of controlling devices on two separate lines. When the Sensor Module detects a signal, it pulses both the Timer and Counter Modules to initiate the start of a cycle. A cycle is composed of one "Delay" interval and one "Duration" interval.



These yellow LED's are for Sensor Channels 1 and 2, and are used to indicate the presence of a signal from the Proximity Sensor(s). The LED(s) will light when a signal is received.

These yellow LED's are used to indicate the setting which has been selected for each sensor channel. (The selection is made by setting slide switches located on the Sensor Module's circuit board.) The top LED's would indicate a "make light" (normally open) mode. The bottom LED's would indicate a "break light" (normally closed) mode. When used with the supplied Proximity Sensor, the top LED's would be lit. When channel two is unused, its slide switch will be set to "Off" and the LED will remain dark.

The yellow (momentary) pushbutton is pressed to initiate a complete test cycle without the presence of an incoming Sensor signal.

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Figure 3 - Sensor Module Front Panel

#### Timer Module

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TIMER

Each timer module controls one "Delay" and one "Duration" interval. When the Timer Module receives a signal from the Sensor Module, the Timer "Delays" the signal until the object is in actual position. It then sends a signal to the Electric Gun (E. G.) Driver Module during the "Duration" portion of the cycle. The device will be triggered during "Duration." The Timer Module's circuit board has a dipswitch that must be set to accept signals from either or both of the Sensor Module Channels.

The top half of the Timer Module is used to control the "Delay" portion of a cycle.

This yellow LED will be lit while the cycle is in "Delay" and the device (spray gun) is waiting to trigger.

This dial is used to adjust the "Delay" to keep the device off, from the time a Sensor signal is received until the object (to be sprayed) reaches the device.

This white pushbutton (latching) is used to select the "range" of the Delay Dial. When depressed, the range is 200 to 2000 milliseconds. When released, the range is 2 to 200 milliseconds.

The bottom half of the Timer Module is used to control the "Duration" portion of a cycle.

This yellow LED will be lit while the cycle is in "Duration" and the device is actually triggering.

This dial is used to adjust the "Duration" to keep the device on for the length of the object.

This white (latching) pushbutton is used to select the "range" of the Duration Dial. When depressed, the range is 200 to 2000 milliseconds. When released, the range is 2 to 200 milliseconds.



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#### **Counter Module**

The Counter Module counts and displays the number of times a device fires when the Sensor signal is received from Sensor Channel 1. The Counter Module also displays either the delay time or duration time which is set for individual Timer Modules. Each time the Sensor Module receives a signal from the Proximity Sensor (through Channel 1 only), it sends a signal to the Counter Module to increase the device triggering count by one.



Figure 5 - Counter Module Front Panel

#### **Electrical Gun (E. G.) Driver Module**

The E. G. Driver Module receives a signal from the Timer Module for the length of the "Duration" interval. The E. G. Driver Module sends a 12VDC signal to the FS output socket and sends an output current to the device for triggering. The output of the timer is a 2 amp pulse which decays to a .9 amp holding current. The voltage across the load is a function of the load impedance. The FS output socket is 12VDC, 25mA.

The E. G. Driver Module is recommended for applications where fast opening times are needed, such as, solenoids or electric guns. If a voltage output is desired, use the 30V Driver Module.





#### **30V Driver Module (Optional)**

The 30V Driver Module receives a signal from the Timer Module for the length of the "Duration" interval. The 30V Driver Module sends a 12VDC signal to the FS output socket and sends a 30VDC signal to the device for triggering. The FS output socket is 12VDC, 25mA.

The 30V Driver Module is recommended for use when the high speed actuation of a device is not critical.

## SECTION 3 INSTALLATION

#### Location and Mounting

Locate the FET-4 Timer in a position that is free from excessive vibrations, dust, and moisture and ambient temperatures above  $120^{\circ}$  Fahrenheit (50° C) or below 32° Fahrenheit (O° C).



# WARNING: The FET-4 Timer must be located in a non-hazardous, non-explosive environment.

The FET-4 Timer is designed for use on a table-type flat surface, or can be mounted on the Optional FET-4 Wall Mounting Bracket. For securing the FET-4 to the flat surface, bolt holes are located beneath the rubber feet on the base of the cabinet. The rubber feet should be left in place to serve as vibration insulators.



CAUTION: Do not locate the FET-4 inside an enclosure or in a position that will interfere with the dissipation of heat through the transistor heat sinks located on the back of the unit.

The FET-4 should be located to allow easy access to the connections at the back of the unit, and where there is enough clearance to open the front door completely.



WARNING: The FET-4 Timer contains electrical potentials that are dangerous and can be fatal. Only qualified personnel should install the FET-4.



CAUTION: To avoid electrical shock during installation and/or servicing, it is recommended that a power disconnect be located on the service line ahead of the FET-4 Timer. Use this device to shut-off all power to FET-4 Timer.

#### Set-Up - Sensor Module Circuit Board



WARNING: Make sure NO electrical voltage is present at the FET-4 BEFORE removing any components.

- 1. Remove Sensor Module from front of FET-4 Timer cabinet.
- 2. Locate Slide Switches S2 and S3 on the Sensor Module's circuit board.







- 3. Slide Switch S2 is for Sensor Channel 1. Place in the "M. L." position ("make-light," normally open) when using the Inductive Proximity Sensor supplied with the FET-4.
- 4. Slide Switch S3 is for Sensor Channel 2. This switch should be in the "Off" position if only one Proximity Sensor is being used with the FET-4. If a second Proximity Sensor is being

used for a separate line, this switch should also be placed in the "M. L." position.

5. Install Sensor Module back in card slot #1 of the FET-4 Timer.

#### Set-Up - Timer Module Circuit Board



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Figure 8 - Timer Module Circuit Board

- 1. Remove Timer Module from front of FET-4 cabinet.
- 2. Locate Dipswitch S3 on Timer Module's circuit board. Dipswitch S3 is used to select whether a signal will be accepted from either or both Sensor Channels 1 and 2. When the switch is in the "closed" position, the signal will be accepted, when the switch is in the "open" position, the signal will be ignored.

- 3. Dipswitch S3-1 is for Sensor Channel 1. When only Sensor Channel 1 is the input for this Timer Module, switch S3-1 is "closed" and S3-2 is "open."
- 4. Dipswitch S3-2 is for Sensor Channel 2. When only Sensor channel 2 is the input for this Timer Module, switch S3-1 is "open" and S3-2 is "closed."

**NOTE:** To make changes in either Dipswitch S3-1 or S3-2 settings, use a pencil point to change the position of the rocker-type switch.

#### Input Voltage Hook-Up & Switch Selection

NOTE: Input voltage must be nominally 100, 115, 200, or 230 VAC, 50/60 Hz, 1 Phase. Connecting any other voltage supply to the FET-4 will result in improper operation of the unit and may result in component damage.



Figure 9 - Line Voltage Hook-up and Selection

- 1. Remove the four screws from the access panel on the back of the FET-4 Timer, and remove panel.
- 2. Route a 100, 115, 200, or 230 VAC service line through the cord connector located at the left of the access panel. Connect the incoming power leads to the input terminal block, and connect the ground lead to the ground stud located below the terminal block. Use a ring-tongue terminal to make the ground connection.



Figure 10 - Input Terminal Block Hook-up

3. Set the two Input Voltage Selection Switches (located beside the input terminal block) to the appropriate setting as indicated in the diagram below.



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Figure 11 - Voltage Selection Switch Settings

#### NOTE: All FET-4 Timers are factory set to 230 VAC to avoid accidental damage to internal components. Setting the switches incorrectly may result in damage to the unit.

- 4. Place the access panel back into position and secure with the four screws that were removed in Step 1.
- 5. Tighten down the gland packing on the cord connector until the service line is fully captured.

#### **Proximity Sensor Location**

Locate Proximity Sensor no more than one object length before the timed device. The Sensor face should be mounted within 4 mm of the object.

#### **Determining "Delay" and "Duration" Time Settings**

 $"Delay" = (D \times C) - Ro$ 

"Duration" =  $(L \times C) - Rc$ 

Where:

Ro = Open Response Time, 12 milliseconds

Rc = Close Response Time, 10 milliseconds

**D** = Distance from Sensor Centerline to Nozzle Centerline (Inches)

L = Length of Object (Inches)

C = Object Speed (Milliseconds per Inch)

To Convert Feet per Minute to Milliseconds per Inch:

<u>Milliseconds</u> = 5000 Inch Object Ft/Min

To Convert Meters per Minute to Milliseconds per Inch:

<u>Milliseconds</u> = <u>1523</u> Inch Object M/Min

**NOTE:** Enter the times established for "Delay" and "Duration" on the Timer Module of the FET-4.

#### **Customer Installation Wiring System WITHOUT Flow Sentry**

**NOTE**: Part numbers for standard components are listed in the Options section of this manual. The length of customer installed cables is determined on a per installation basis.

#### **Output Cable**

The Output Cable connects the FET-4 to the device to be timed. This is a two-conductor cable that does not need to be shielded. The conductor size for this cable should be 18-22 AWG.



Figure 12 - Output Cable Wiring Diagram





#### Sensor Signal Cable Without Intrinsic Safety Barriers

The Sensor Cable without Intrinsic Safety Barriers connects the FET-4 to the Proximity Sensor. This is a three-conductor cable that does not need to be shielded. The conductor size for this cable should be 18-22 AWG.

See Figure 13 for the wiring diagram for a sensor cable without intrinsic safety barriers.



CAUTION: This cable WITHOUT Intrinsic Safety Barriers should only be used for systems that DO NOT use solvent based materials.

#### Sensor Signal Cable With Intrinsic Safety Barriers, Customer Supplied

The Sensor Signal Cable with Intrinsic Safety barriers connects the FET-4 to the Proximity Sensor through Intrinsically Safe Barriers. This cable is a three-conductor cable that needs to be shielded. The shield should NOT be connected at the plug end. Conductor size should be 18-22 AWG.

#### NOTE: This cable WITH Intrinsic Safety Barriers should be used for systems that use solvent based materials.

See Figure 14 for the Sensor Signal Cable with Intrinsic Safety Barriers



# **NOTE:** Three-pole connector and Proximity Sensor are supplied with the FET-4 Timer.

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### SECTION 4 PREVENTIVE MAINTENANCE

#### Introduction

The following pages cover preventive maintenance. Preventive maintenance includes procedures such as periodic inspection and cleaning.



WARNING: The FET-4 Timer contains electrical potentials that are dangerous and can be fatal. Exercise extreme caution when working with this equipment. Only qualified personnel should service the FET-4.



WARNING: The input terminal block and the terminals on the main circuit breaker behind the front panel remain energized even when the FET-4 is turned OFF at the circuit breaker. Disconnect and lock out external power to the unit before performing any maintenance that requires removal of the cabinet cover or inspection of components inside the electrical access panel.



WARNING: The large capacitors in the Power Module remain charged for a short time after the unit has been turned off. After turning the unit off, allow at least 30 seconds for the capacitors to discharge before starting to work on the Power Module or related components. Failure to observe this precaution could result in fatal personal injury.

NOTE: Digital logic circuit boards are highly sensitive to static electricity, high temperature, and foreign substances. To avoid damage to the boards, always observe the following precautions when handling, storing, or transporting modules. Page 24

- 1. Turn the power OFF at the main circuit breaker on the front panel before inserting or removing modules.
- 2. Use the handle at the top of the module faceplate when removing the modules from the cabinet and when carrying them from place to place. If it is necessary to handle the printed circuit boards, do so by the edges only. Do not place fingers on the surface of the board, as skin oils affect the components and can degrade the performance of the board.
- 3. Do not place modules on hot surfaces, near heavy electrical equipment or strong magnetic fields, or on ungrounded surfaces of any kind.
- 4. To avoid damage to the boards from static electricity, all personnel should ground themselves while handling the modules.
- 5. All digital circuit boards must be stored and transported in the special, conductive plastic bags provided in the shipping carton. Never place the modules in conventional plastic bags or trays. For shipping, use the foam packing materials provided with the unit.

#### **Periodic Maintenance**

Like all solid state devices, the FET-4 requires little periodic maintenance. The unit should be checked on a regular basis for loose or missing hardware, frayed or pinched cables, and physical damage to the components. In applications where the FET-4 is exposed to adverse environmental conditions (i.e., large amounts of dust, moisture, and airborne material) the cabinet, cables, and other components should be wiped down as a part of regular plant maintenance procedures. Do not hose down the unit.

## SECTION 5 TROUBLESHOOTING

#### Problem: Circuit Breaker Trips and Will Not Stay On When Reset

Cause: 1) Short circuit in cables or other external components

**Procedure A1**: With power "Off," remove all connectors from back of FET-4 Timer. Turn power "On."

If circuit breaker still trips, skip to Procedure A2.

If circuit breaker stays on, turn power "Off" and reconnect the cables one at a time, beginning with Sensor and working out toward the device(s). Retest the circuit breaker after each cable. If the circuit breaker trips, check for a short circuit in the cable that was connected last, and in all components connected to the cable.

Cause: 2) Short circuit in modules

**Procedure A2:** Open the FET-4 cabinet door and pull all modules out until they are disconnected from the Mainframe board (approximately one inch). Turn power "On."

NOTE: Before removing or inserting any module, make sure power is "OFF." DO NOT remove or insert modules while power is "ON." Disconnect and lockout external power. Failure to observe this precaution may result in permanent damage to the modules.

If circuit breaker still trips, replace Power Module.

If main circuit breaker stays on, turn unit "Off" and reinsert modules one at a time. Begin with the Sensor Module and work toward the E. G. Driver Module(s). Retest the circuit breaker after inserting each module. When the circuit breaker trips, replace the module that was inserted last and check for proper operation.



Figure 15 - FET-4 Timer Wiring Diagram

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#### **Problem: Device Will Not Fire**

#### Cause: 1) No signal to FET-4 timer

**Procedure:** To check for a loss of trigger signal to the Timer, press the yellow test button on the Sensor Module. As long as the test button is depressed, the LED's on the Sensor Module will be lit.

As soon as the test button is depressed, the Timer Module begins the delay interval and lights the delay LED. After the delay interval is completed, the duration interval begins, and the duration LED is lit.

When the duration interval begins, the Timer Module sends a signal to turn on the E. G. Driver Module. The E. G. Driver Module LED lights, and the device fires.

If the device does not fire when the Sensor Module test button is used, the problem lies in the modules or in the output wiring. If there is no trigger signal to the Sensor Module and the device fires by pressing the Sensor Module test button (meaning the modules and the output wiring are okay), then refer to Cause: 2 below.

Cause: 2) Malfunctioning Proximity Sensor

Procedure: To determine if there is a malfunctioning Proximity Sensor, duplicate a signal out of the Proximity Sensor by connecting a jumper wire between Pin #1 and Pin #2 at the receiver socket of the sensor input. The receiver socket is on the back panel of the FET-4 (see Figure 16). This should signal the Sensor Module and light the Sensor LED.

If the Sensor Module does not receive the signal, then the problem is between the receiver socket and the Sensor Module. Take the cabinet cover off and check the wiring from the socket to the mainframe board.

If the Sensor Module does receive the signal, then check the sensor plug and/or replace the Proximity Sensor.



Figure 16 - FET-4 Timer Back View

Cause: 3) Malfunctioning Sensor Module

**Procedure:** If pressing the Sensor Module test button does not light the Sensor Module LED, replace the Sensor Module.

If a new Sensor Module does not work, check for 12VDC between Pin #1 (the uppermost pin) and Pin #22 (the lowest pin) on the Sensor Module card socket of the mainframe board (see Figure 17). Pin #1 is common, and Pin #22 is 12VDC. If there is no voltage, check fuse F1 on the power supply. Also check the wiring from the power supply to the mainframe board.

Cause: 4) Malfunctioning Timer Module

**Procedure:** If the LED on the Sensor Module lights, but the delay and/or duration LED's on the Timer Module do not light, replace the Timer Module.

If the new Timer Module does not light, check for 22VDC between Pin #1 and Pin #8 on the Timer Module socket of the mainframe



Figure 17 - Card Cage

©NORDSON CORPORATION 1987 All Rights Reserved board. If there is no voltage, check fuse F1 on the power supply and the wiring from the power supply to the mainframe board.

#### Cause: 5) Malfunctioning E. G. Driver Module

**Procedure:** To check for a defective E. G. Driver Module, Press the test button on the module. The device should fire and the LED should light.

If the LED does not light, check for 12VDC between Pin #1 and Pin #2 on socket slot #10 of the mainframe board, and check for -30VDC between Pin #1 (common) and Pin #20.

#### NOTE: Be very careful not to short any pin to an adjacent pin. Damage to the power supply may result.

If the LED does light but the device does not fire, check the wiring from the mainframe board to the device. If the wiring is good, replace the Transistor Heat Sink Assembly.

#### **Problem:** Counter Does Not Count or Display Time

#### Cause: No voltage to the Counter Module

**Procedure:** Check for 12VDC between Pin #1 (common) and Pin # 22 on socket slot #6 of the mainframe board. If voltage is present, replace the Counter Module.

#### **Problem:** Counter Does Not Count, Display Time or Duration

Cause: <u>Defective Counter Module</u>

**Procedure:** Replace Counter Module.

#### Problem: No Signal to FS Output Socket

**Cause: 1)** <u>12VDC power supply input to driver module insufficient</u> or not present

**Procedure:** Press the test button on the E. G. Driver Module. If the E. G. Driver Module LED lights, the problem is in the wiring

between the mainframe board and the FS (Flow Sentry) output socket OR there is a defective driver module.

Cause: 2) Defective wiring to the FS output socket

**Procedure:** Change the E. G. Driver Module from socket slot #7 to socket slot #8. Press the test button on the E. G. Driver Module, and test for 12VDC by plugging in a voltmeter at the corresponding FS output socket on the Flow Sentry panel.

- Driver slot 1 (socket slot #7) corresponds to the upper left FS socket.
- Driver slot 2 (socket slot #8) corresponds to the upper right FS socket.
- Driver slot 3 (socket slot #9) corresponds to the lower left FS socket.
- Driver slot 4 (socket slot #10) corresponds to the lower right FS socket.

If voltage is not present, replace the E. G. Driver Module.

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## SECTION 6 DISASSEMBLY AND REPAIR

#### Modules

NOTE: Before removing modules from the cabinet, read the instructions for handling, storage, and transporting digital logic circuit boards in Section 4.

Except for the Power Module, all modules are removed from the front of the unit by disengaging the module handle from the upper lip of the cabinet and pulling the card free from its mounting on the card cage of the Mainframe Board (see Figure 17). For removal of the Power Module, Mainframe Board, Power Transistors, and Zener Diode see below.

The modules in the FET-4 are not field serviceable. If found to be defective, they must be removed and replaced with a new module.

When returning modules, always use the special non-conductive plastic bags and foam packing materials provided with the unit. Pack the modules carefully to avoid damage in transit.

#### **Power Module Replacement**

1. Disconnect and lock out external power to the unit.



WARNING: The input terminal block and the terminals on the main circuit breaker behind the front panel remain energized even when the FET-4 is turned OFF at the main circuit breaker. Disconnect and lock out external power to the unit before removing the cabinet cover or opening the electrical access panel at the rear of the cabinet. Failure to observe this precaution may result in fatal personal injury.



WARNING: The large capacitors in the Power Module remain charged for a short time after the unit has been turned off. After turning the unit off, allow at least 30 seconds for the capacitors to discharge before starting to work on the Power Module or related components. Failure to observe this precaution could result in fatal personal injury.

- 2. Remove the electrical access panel and disconnect the two incoming power leads from terminals L1 and L2 and the ground wire from the ground stud.
- 3. Loosen the four captive screws at each side of the cabinet cover and lift the cover off the unit.
- 4. Disconnect wires L1, L2, 9, and 10 from the circuit breaker on the front panel and wires 7 and 8 from the indicator light.
- 5. Unplug the power supply high and low voltage cables from connectors J11 and J21 on the Mainframe Board.
- 6. Remove the four screws securing the Power Module to the cabinet base and lift the module out of the cabinet.
- Reinstall the Power Module by reversing Steps 1 through 6.
   Wires L1 and L2 are connected at the top of the circuit breaker, wires 9 and 10 at the bottom. The higher numbered wire of each pair goes toward the outside of the cabinet.



Figure 18 - Mainframe Board Back View

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#### **Mainframe Board Replacement**

1. Disconnect and lock out external power to the unit.



WARNING: The input terminal block and the terminals on the main circuit breaker behind the front panel remain energized even when the FET-4 is turned OFF at the main circuit breaker. Disconnect and lock out external power to the unit before removing the cabinet cover or opening the electrical access panel at the rear of the cabinet. Failure to observe this precaution could result in fatal personal injury.



WARNING: The large capacitors in the Power Module remain charged for a short time after the unit has been turned off. After turning the unit off, allow at least 30 seconds for the capacitors to discharge before starting to work on the Mainframe Board or related components. Failure to observe this precaution could result in fatal personal injury.

- 2. Remove all modules from the card cage and set them aside.
- 3. Loosen the two captive screws at each side of the cabinet cover and lift the cover off the unit.
- 4. Remove the four screws from the bottom of the rear panel and lower the panel to gain access to the rear of the Mainframe Board.
- 5. Disconnect all cables from the connectors on the Mainframe Board and separate the rear panel from the unit.
- 6. Remove eight self-tapping screws from the Mainframe Board and separate the Mainframe Board from the Card Cage.
- 7. Reinstall the Mainframe Board by reversing Steps 1 through 6.

#### **Power Transistor and Zener Diode Replacement**

The transistor for each Driver Module is located directly behind the module it serves. The zener diode is mounted on the heat sink behind slots 3 and 4

1. Disconnect and lock out external power to the unit.



WARNING: The input terminal block and the terminals on the main circuit breaker behind the front panel remain energized even when the FET-4 is turned OFF at the main circuit breaker. Disconnect and lock out external power to the unit before removing the cabinet cover or opening the electrical access panel at the rear of the cabinet. Failure to observe this precaution could result in fatal personal injury.

- 2. Loosen the four captive screws at each side of the cabinet cover and remove the cover from the unit.
- 3. Remove the four screws holding the transistor or diode heat sink in place on the rear panel and remove the heat sink.
- 4. Remove the two screws securing the transistor/diode and remove it from its socket.

NOTE: Be careful not to damage the insulating material on the mounting bracket when removing or installing the transistor/diode. The insulation is essential to its proper operation.

5. Reinstall the transistor/diode by reversing Steps 1 through 4.

## SECTION 7 ILLUSTRATED PARTS LIST

#### Introduction

The FET-4 Timer is broken into four views to give the best presentation of each part. Some part numbers are repeated from view to view; most are not. Check all views when searching for a part.

The number in the Ref column indicates the number assigned to the part in the associated figure. A dash is used for parts that are not shown.

The letter in the Note column is a reference to an unusual circumstance for this particular part, and it is explained further at the end of the list.

The number in the Part No. column indicates the Nordson part number for the part. A dash signifies that the item is a nonsaleable part or a nonsaleable subassembly of a saleable assembly.

The Description column gives the name of the part together with its dimensions and other physical properties, where appropriate. Indented parts are subgroups of a major assembly or subassemblies. For example:

1	248 356	FET-4 Timer
2	273 144	. Panel, Assembly Access
3	296 168	Gasket, Access Panel

If you order number 1, items 2 and 3 will be included. If you order number 2, item 3 will be included. If you order number 3, you will receive only number 3.

The number in the Qty column indicates the quantity required per unit or assembly. When the quantity is not applicable, a dash appears in the column.



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Figure 19 - FET-4 Timer With Power Module Top View

#### **Top View**

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Ref	Note	Part No.	Description	Qty
				•
-		$248\ 356$	FET-4 Timer	-
1		296 022	. Guide, Card	20
2		-	. Rod, Threaded, M5 x 0.8 x 5.51 mm, STL	4
3		-	. Lockwasher, EXT, M5, ZN	12
4		-	. Nut, Hex, M5, ZN	4
5		248 359	. Module, Power Supply	1
6		-	. Screw, Pan Head, M5 x 6 mm, ZN	4
7		-	. Nut, Hex, .50 NPT	1
8		933 005	. Connector, Cord	1
9		273 144	. Panel, Assembly, Access	1
-		296 168	Gasket, Access Panel	1
10		-	Screw, Captive, M4 x 8.4 mm	4
11		248 348	. Panel, FS, Interface	1
12		296 047	. Heat Sink, Transistor	1
13		296 046	. Heat Sink, Zener, Assembly	1
14		-	. Screw, Pan Head, M3.5 x 0.6 x 6 mm, ZN	24
15		-	. Lockwasher, EXT #6, ZN	24
16		248 353	. Circuit Board, Mainframe	1



Figure 20 - FET-4 Timer Front View

#### **Front View**

Ref	Note	Part No.	Description	$\mathbf{Qty}$
-		$248 \ 356$	FET-4 Timer	
1		296 022	. Guide, P.C., Card, Slotted	20
2		296 174	. Door, Assembly	1
3		-	. Screw, Flat HD, SLT, M4 x 13, ZN	3
4		296 073	. Module, Blank	6
5		248 355	. Module, Driver, E. G., FET-4	1
6		296 051	. Module, Timer	1
7		296 065	. Module, Sensor	1
8		-	. Screw, PH, M3 x 0.5 x 5 mm, ZN	2
9		902 522	. Retainer, Stud, .028	1
10		296 008	. Lamp, 28V, White Lens, Rect	1
11		296 009	. Breaker, Circuit, 2-Pole, 250V, 2A	1
12		-	. Screw, Flat HD, SLT, M3 x 6, ZN	$\frac{1}{2}$
13		296 164	. Gasket, Door	1
14		248 352	. Module, Counter, FET-4	1





#### **Back View**

Ref	Note	Part No.	Description	Qty
÷				
-		$248\ 356$	FET-4 Timer	
1		-	. Lockwasher, EXT, M4, ZN	7
2		-	. Screw, PH, M4 x 0.7 x 8 mm, ZN	7
3		$248\ 348$	. Panel, FS, Interface	1
4		296 046	. Heat Sink, Zener	1
5		296 047	. Heat Sink, Transistor	1
6		-	. Pad, MTG.	4
7		-	. Screw, PH, M6 x 1 x 16 mm, ZN	4
8		-	. Screw, PH, M3.5 x 0.6 x 6 mm, ZN	24
9		-	. Lockwasher, EXT #6, ZN	24
10		$273\ 144$	. Panel, Assembly, Access	1
11		933 005	. Connector, Cord	1
<u>12</u>		-	. Locknut, Conduit	1



Figure 22 - Cover Detail

#### **Cover Detail**

Ref	Note	Part No.	Description	Qty
-		248 356	FET-4 Timer	
1		-	. Screw, PH, M4 x 0.7 x 10 mm, ZN	4
2		-	. Lockwasher, EXT, M4, ZN	4
3		-	. Washer, Flat, M4	4

## Parts shipped loose with the FET-4.

Part No.	Description	Qty
0.40.000		_
248 368	Sensor, Proximity, FET-4	1
$248\ 350$	Connector, Male, 3-Pole	1
296 094	Connector, Male, 2-Pole	1
296 007	Key, Tool, Head	1

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#### **Recommended Spare Parts**

Part No.	Description	Qty
296 008	Lamp w/Speed Nut	1
296 009	Breaker, Circuit, 2-Pole, 250 VAC, 2A	1
296 065*	Module, Sensor, FET-4	1
296 051*	Module, Timer, FET-4	1
$248\ 352$	Module, Counter, FET-4	1
248 355*	Module, E. G. Driver, FET-4	· 1
296 118	Transistor, Power	2
296 121	Diode, Zener	1
296 095	Connector, Male, 3-Pole	1
296 094	Connector, Male, 2-Pole	1
$248\ 350$	Connector, Male, 3-Pole	1
937 121	Lamp, Photocell Light Source	1

\*For all applications, Nordson recommends purchase of at least one additional Timer and an additional E. G. Driver Module. Purchase a spare Sensor Module only if dual trigger capability is required for application.

## SECTION 8 TECHNICAL DATA

#### Dimensions

6.3"H x 22.4"W x 14.5"D (16.0cm H x 57.0cm W x 36.9cm D)

#### Weight

48.5 lbs. (22.0 kg.)

#### **Ambient Temperature Range**

32-132° F (0-55° C)

#### Electrical

100/115/200/230 VAC, 50/60 Hz. Single Phase - 4 Amp Max.

#### Number of Channels

1 to 4 parallel channels

#### **Timing Ranges**

low range: 2-200 ms  $\pm$  10% high range 200-2000 ms  $\pm$  10% Repeat Accuracy -  $\pm$  .5 ms Temperature drift -  $\pm$  1% over ambient temperature range

#### **Counter Module**

Delay/Duration range - 2-2000 ms  $\pm$  10% Accuracy -  $\pm$  .5 ms Counting range up to 99,999,999 cans in Xl mode up to 999,999,990 cans in Xl0 mode Manual 17-7 Page 44

## **Drive Output - Electric Guns**

4 amps max. (2 guns)

## SECTION 9 OPTIONAL PARTS

#### **System Options**

Part Number

FET-4 Wall Mounting Bracket	248 339
Kit, Proximity Sensor (See Note A)	248 368
. Proximity Sensor	$248\ 351$
. 3-Pole Male Connector	296 095
Kit, Expansion, FET-4 w/Timer (See Note B)	106 410
. E. G. Driver Module	$248\ 355$
. Transistor Heat Sink Assembly	296 047
. Timer Module (FET-4)	296 051
Kit, Expansion, FET-4 (See Note C)	106 409
. E. G. Driver Module	248 355
. Transistor Heat Sink Assembly	296 047
Connector, 3-Pole Male (See Note D)	$248\ 350$
Connector, 2-Pole Male (See Note E)	296 094
30V Driver Module	296 063
FET-4 Timer	$248\ 356$
. FET-4 Proximity Sensor	248 351
. 3-Pole Male Connector	296 095
. 2-Pole Male Connector (See Note E)	296 094
. 3-Pole Male Connector (See Note D)	$248\ 350$

#### NOTES:

System Options

A - An additional Inductive Proximity Sensor is required for installations that are using one FET-4 to control two devices on two separate lines.

B - An Expansion Kit with Timer is required for installations that are using one FET-4 to control two devices on two separate lines (see Note E).

C - An Expansion Kit without Timer is required for installations that are using one FET-4 to control two devices on one line (see Note E).

**NOTES** (Continued):

D - Pin #1 is removed from this connector. This connector is supplied with the FET-4. It is used to connect a signal device to the FET-4.

E - This connector must be ordered separately when ordering any Expansion Kit that contains an E. G. Driver Module.

#### **Customer Supplied Components**

#### NOTE: Refer to Section 3 Installation for wiring instructions.

Description	Qty
Power Cable, 2-Conductors	1
Sensor Signal Cable, 3-Conductors	1
Interface Cable, 2-Conductor	1
Optional Safety Barriers, 12VDC, 100mA, 160 Ohm	3