Woodward’s extensive line of solenoid protection products feature either external or internal electronics. Coil Commanders™ and pull coil timer modules (PCTMs) are externally attached to the solenoid to prevent overheating of the pull coil. ICE (Integrated Coil Electronics) and AICE (Advanced ICE) solenoids have built-in electronics that prevent overheating of the pull coil.
External Electronic Solenoid Controls

Coil Commanders™ and PCTM Protection Systems
Dual coil solenoids are constructed of two wound coils. The pull coil operates at high currents in order to provide maximum pull or push force. The hold coil retains the plunger in place after it has completed its stroke. After energizing, the pull coil must be turned off as soon as possible to prevent burnout. The protection modules energize the solenoid pull coil for approximately 1.0 second.

Woodward makes two types of externally controlled solenoid protection systems: Coil Commander™ modules and pull coil timer modules (PCTM).
Coil Commander™ Modules
Coil Commanders time out a solenoid’s high amperage pull coil within approximately 1.5 seconds. The in-line cylindrical tube design comes in 5-, 6-, and 7-wire SSR configurations:

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Function Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-Wire Module</td>
<td>When used with a 3-wire externally switched solenoid, the combined unit functions similarly to an internally switched solenoid without modification to existing wiring harness.</td>
</tr>
<tr>
<td>6-Wire Module</td>
<td>Provides a quick, easy fix to prevent burnout for externally switched installations that are connected to the “S” terminal on the starter.</td>
</tr>
<tr>
<td>7-Wire SSR Module</td>
<td>When used with a 4-wire externally switched solenoid, the combined unit functions similarly to an internally switched solenoid and eliminates the need for a separate solenoid relay.</td>
</tr>
</tbody>
</table>

Stand-alone units are lightweight and need no mounting brackets. Modules are also available with solenoid attached.

Maximum ON/OFF Duty Cycles for Coil Commander™ Modules
At de-rated conditions: 125% of rated voltage and 250°F (121°C)

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Continuous</th>
<th>Intermittent</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Vdc</td>
<td>2 cycles/minute</td>
<td>4 cycles/minute for 5 minutes</td>
</tr>
<tr>
<td>24 Vdc</td>
<td>1 cycle/minute</td>
<td>3 cycles/minute for 5 minutes</td>
</tr>
</tbody>
</table>

PCTM Modules
These timers protect externally switched solenoids by limiting the pull coil ON time to 0.5 second. Use of a PCTM enhances solenoid performance by providing functionality of an internally switched solenoid but with greater durability and reliability.

Note: Coil Commanders and PCTM’s will reduce the available pull coil voltage by approximately 0.5 to 1 volt.
5-Wire Coil Commander™

Provides the functionality of an internally switched solenoid when used with a 3-wire externally switched solenoid.

Features:
- Prevents solenoid burnout due to engine over cranking or misadjustment of linkage by limiting the pull coil ON time
- Potted and sealed solid-state electronics
- Separate mounting bracket not required
- Stand alone plug-in or factory assembled to solenoid
- Patented

Order Information:

Stand Alone Modules

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>Rated Voltage</th>
<th>Max. Current at 68˚F (20˚C)</th>
<th>Terminations To System Harness</th>
<th>Terminations To Solenoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-4624-12</td>
<td>12 Vdc</td>
<td>70 A</td>
<td>Leads</td>
<td>Packard Weather Pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Housing No. 12020829</td>
</tr>
<tr>
<td>SA-4624-24</td>
<td>24 Vdc</td>
<td>40 A</td>
<td>Leads</td>
<td>Packard Weather Pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Housing No. 12020829</td>
</tr>
<tr>
<td>SA-4626-12</td>
<td>12 Vdc</td>
<td>70 A</td>
<td>Packard Weather Pack</td>
<td>Packard Weather Pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Housing No. 12020827</td>
<td>Housing No. 12020829</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Housing No. 12020827</td>
<td>Housing No. 12020829</td>
</tr>
<tr>
<td>SA-4630-12</td>
<td>12 Vdc</td>
<td>70 A</td>
<td>Packard Weather Pack</td>
<td>Yazaki Housing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Housing No. 12010973</td>
<td>No. 7123-2137</td>
</tr>
<tr>
<td>SA-4634-12</td>
<td>12 Vdc</td>
<td>90 A</td>
<td>Packard Weather Pack</td>
<td>Packard Weather Pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Housing No. 12010973</td>
<td>Housing No. 12020829</td>
</tr>
<tr>
<td>SA-4634-24</td>
<td>24 Vdc</td>
<td>60 A</td>
<td>Packard Weather Pack</td>
<td>Packard Weather Pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Housing No. 12010973</td>
<td>Housing No. 12020829</td>
</tr>
<tr>
<td>SA-4686-12</td>
<td>12 Vdc</td>
<td>70 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4686-24</td>
<td>24 Vdc</td>
<td>40 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4687-12</td>
<td>12 Vdc</td>
<td>90 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4687-24</td>
<td>24 Vdc</td>
<td>60 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4822-12</td>
<td>12 Vdc</td>
<td>90 A</td>
<td>Metri-Pack 280 Series Housing</td>
<td>Packard Weather Pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No. 15300002</td>
<td>Housing No. 12020829</td>
</tr>
</tbody>
</table>

Built-in Modules

Contact Woodward for factory assembled units

Minimum quantities required for non-standard configurations. Contact factory for details.
5-Wire Coil Commander™

Electric shutoff with dedicated relay for fuel solenoid

Specifications:
- Temperature: -40°F to +250°F (-40°C to +121°C)
- Vibration: 15 G's @ 15-2000 Hz
- Rated Voltage: Minimum Input Voltage @ 68°F (20°C)
  - 12 Volt: 9 Vdc
  - 24 Volt: 18 Vdc
- Rated Jump Start Voltage: 24 Vdc
- Reverse Polarity Protection: None
- Weight: Approx. 4 oz. (113 g)

Note: Coil Commanders will reduce the available pull coil voltage by approximately 0.5 to 1 volt.

E.E.C. Directive Compliance: All parts supplied by Woodward are classified as components, and therefore are not "CE" marked. Please contact factory direct for details on specific product compliance with 89/336/EEC and 89/392/EEC directives.
6-Wire Coil Commander™
Plugs into existing externally switched solenoid installations without wiring modification when used with optional connectors. Works with installations connected to “S” terminal on starter.

Features:
- Prevents solenoid burnout due to engine over crank or misadjustment of linkage by limiting the pull coil ON time
- Potted and sealed solid-state electronics
- Separate mounting bracket not required
- Stand alone plug-in or factory assembled to solenoid
- Patented

Order Information:

Stand Alone Modules

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>Rated Voltage</th>
<th>Max. Current at 68°F (20°C)</th>
<th>Terminations To System Harness</th>
<th>Terminations To Solenoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-4751</td>
<td>9-36 Vdc</td>
<td>86 A</td>
<td>Packard Weather Pack Housing No. 12020827</td>
<td>Packard Weather Pack Housing No. 12020829</td>
</tr>
<tr>
<td>SA-4759</td>
<td>9-36 Vdc</td>
<td>86 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4945*</td>
<td>9-36 Vdc</td>
<td>86 A</td>
<td>Yazaki Housing-Male No. 7122-2237-00</td>
<td>Yazaki Housing-Female No. 7123-2137</td>
</tr>
<tr>
<td>SA-5028</td>
<td>9-36 Vdc</td>
<td>86 A</td>
<td>Packard Metri-Pack 280 Housing No. 1530003</td>
<td>Packard Metri-Pack 280 Housing No. 12040977</td>
</tr>
<tr>
<td>SA-5160</td>
<td>9-36 Vdc</td>
<td>86 A</td>
<td>Yazaki Housing-Male No. 7122-2237-00</td>
<td>Yazaki Housing-Female No. 7123-2137</td>
</tr>
</tbody>
</table>

*For use with Kubota 1503ES solenoids

Built-in Modules
Contact Woodward for factory assembled units
Minimum quantities required for non-standard configurations. Contact factory for details.

TERMINATION CONNECTIONS

E.E.C. Directive Compliance: All parts supplied by Woodward are classified as components, and therefore are not “CE” marked. Please contact factory direct for details on specific product compliance with 89/336/EEC and 89/392/EEC directives.
**6-Wire Coil Commander™**

**Electric Shutoff**

- Electric shutoff with dedicated relay for fuel solenoid
- Connection of solenoid to “S” terminal is acceptable with 6-wire Coil Commander.
- Note: Coil Commanders will reduce the available pull coil voltage by approximately 0.5 to 1 volt.

**Specifications:**

- **Temperature**
  - -40°F to +250°F
  - (-40°C to +121°C)
- **Vibration**
  - 15 G's @ 15-2000 Hz
- **Rated Voltage**
  - Minimum Input Voltage
    - 12 Volt
    - 9 Vdc
    - 24 Volt
    - 18 Vdc
  - Rated Jump Start Voltage
    - 1 cycle/min for 10 min
    - 24 Vdc
    - 36 Vdc
- **Reverse Polarity Protection**
  - None
- **Weight**
  - Approx. 4 oz. (113 g)

**Recommended Connection**

- Connection of solenoid to “S” terminal is acceptable with 6-wire Coil Commander.

**Non-Recommended Connection**

- Connection of solenoid to “S” terminal is not recommended.

**Specifications are for reference only.**

- e-mail: icinfo@woodward.com
7-Wire SSR Coil Commander™

Provides the functionality of an internally switched solenoid when used with a 4-wire externally switched solenoid. Eliminates the need for a separate solenoid relay.

Features:
- Prevents solenoid burnout due to engine over cranking or misadjustment of linkage by limiting the pull coil ON time
- Potted and sealed solid-state electronics
- Separate mounting bracket not required
- Stand alone plug-in or factory assembled to solenoid
- Patented

Order Information:

Stand Alone Modules

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>Rated Voltage @ 68°F (20°C)</th>
<th>Max. Current (20°C)</th>
<th>Terminations To System Harness</th>
<th>Terminations To Solenoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-4690-12</td>
<td>12 Vdc</td>
<td>70 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4690-24</td>
<td>24 Vdc</td>
<td>40 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4691-24</td>
<td>24 Vdc</td>
<td>60 A</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4727-12</td>
<td>12 Vdc</td>
<td>86 A</td>
<td>Packard Weather Pack Housing No. 12020827</td>
<td>Packard Weather Pack Housing No. 12020832</td>
</tr>
<tr>
<td>SA-4727-24</td>
<td>24 Vdc</td>
<td>56 A</td>
<td>Packard Weather Pack Housing No. 12020827</td>
<td>Packard Weather Pack Housing No. 12020832</td>
</tr>
</tbody>
</table>

Built-in Modules
Contact Woodward for factory assembled units.

Minimum quantities required for non-standard configurations. Contact factory for details.

E.E.C. Directive Compliance: All parts supplied by Woodward are classified as components, and therefore are not “CE” marked. Please contact factory direct for details on specific product compliance with 89/336/EEC and 89/392/EEC directives.
7-Wire SSR Coil Commander™

TERMINATION CONNECTIONS

CONNECT TO SYSTEM HARNESS

CONNECT TO SOLENOID

SSR ELECTRIC SHUTOFF

SSR electric shutoff for use with externally switched solenoids and to replace or eliminate a second solenoid relay.

SSR THROTTLE/CHOKE SOLENOID

SSR throttle/choke solenoid eliminates need for mechanical relay.

DIMENSIONS

Specifications:

Temperature
-40°F to +250°F (-40°C to +121°C)

Vibration
15 G's @ 15-2000 Hz

Rated Voltage

<table>
<thead>
<tr>
<th>Minimum Input Voltage @ 68°F (20°C)</th>
<th>12 Volt</th>
<th>24 Volt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Jump Start Voltage (&lt;5 min)</td>
<td>9 Vdc</td>
<td>18 Vdc</td>
</tr>
<tr>
<td></td>
<td>24 Vdc</td>
<td>48 Vdc</td>
</tr>
</tbody>
</table>

Reverse Polarity Protection
None

Weight
Approx. 4 oz. (113 g)

Note: Coil Commanders will reduce the available pull coil voltage by approximately 0.5 to 1 volt.
PCTM Modules
Pull coil timer modules protect externally switched solenoids by limiting the pull coil ON time. Use of a PCTM enhances solenoid performance by providing functionality of an internally switched solenoid but with greater durability and reliability.

Features:
- 3- and 6-wire configurations for externally switched solenoids
- Can be mounted in any orientation or location
- Potted and sealed solid-state electronics
- Corrosion resistant

Order Information:

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>Wire Configuration</th>
<th>Rated Voltage</th>
<th>Terminations To System Harness</th>
<th>Terminations To Solenoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA-4092-12</td>
<td>3-Wire</td>
<td>12 Vdc</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4092-24</td>
<td>3-Wire</td>
<td>24 Vdc</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4094-12</td>
<td>3-Wire</td>
<td>12 Vdc</td>
<td>Packard Weather Pack Housing No. 12020827</td>
<td>Packard Weather Pack Housing No. 12020827</td>
</tr>
<tr>
<td>SA-4094-24</td>
<td>3-Wire</td>
<td>24 Vdc</td>
<td>Packard Weather Pack Housing No. 12020827</td>
<td>Packard Weather Pack Housing No. 12020827</td>
</tr>
<tr>
<td>SA-4220-12</td>
<td>6-Wire</td>
<td>12 Vdc</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4220-24</td>
<td>6-Wire</td>
<td>24 Vdc</td>
<td>Leads</td>
<td>Leads</td>
</tr>
<tr>
<td>SA-4222-12</td>
<td>6-Wire</td>
<td>12 Vdc</td>
<td>Packard Weather Pack Housing No. 12010717</td>
<td>Packard Weather Pack Housing No. 12015793</td>
</tr>
<tr>
<td>SA-4224-12</td>
<td>6-Wire</td>
<td>12 Vdc</td>
<td>Leads</td>
<td>Packard Weather Pack Housing No. 12020827</td>
</tr>
<tr>
<td>SA-4224-24</td>
<td>6-Wire</td>
<td>24 Vdc</td>
<td>Leads</td>
<td>Packard Weather Pack Housing No. 12020827</td>
</tr>
</tbody>
</table>

Minimum quantities required for non-standard configurations. Contact factory for details.

E.E.C. Directive Compliance: All parts supplied by Woodward are classified as components, and therefore are not “CE” marked. Please contact factory direct for details on specific product compliance with 89/336/EEC and 89/392/EEC directives.
3-Wire Pull Coil Timer Module

**Specifications:**
- **Temperature:** -40˚F to +185˚F (-40˚C to +85˚C)
- **Input Voltage:**
  - 12 Vdc
  - 24 Vdc
- **Pull Current:**
  - 70 A @ 12 Vdc
  - 56 A @ 24 Vdc
- **Vibration:** 15 G’s @ 15–2000 Hz
- **Maximum Cycles:** 3 cycles/minute continuous
- **Energized Time:** 0.5 seconds

**DIMENSIONS**

![Dimensions Diagram]

**Note:** PCTM’s will reduce the available pull coil voltage by approximately 0.5 to 1 volt.

6-Wire SSR Pull Coil Timer Module

**Specifications:**
- **Temperature:** -40˚F to +185˚F (-40˚C to +85˚C)
- **Input Voltage:**
  - 12 Vdc (30 Vdc jump start)
  - 24 Vdc (57 Vdc jump start)
- **Pull Current:**
  - 70 A @ 12 Vdc
  - 56 A @ 24 Vdc
- **Vibration:** 15 G’s @ 15–2000 Hz
- **Maximum Cycles:** 3 cycles/minute continuous
- **Energized Time:** 0.5 seconds

**DIMENSIONS**

![Dimensions Diagram]

**WIRING DIAGRAM**

![Wiring Diagram]
Integrated Coil Electronic Solenoids

Ideal for custom applications, Woodward’s Integrated Coil Electronics (ICE and Advanced ICE) solenoids have built-in electronics that prevent overheating of the pull coil. The electronics on both products are totally encapsulated onto the solenoid to ensure reliability in the harshest environments. And, both feature reverse polarity protection.
**Integrated Coil Electronics (ICE)**

*For Dual Coil Solenoids*

A printed circuit board mounted onto a dual coil solenoid provides a timer circuit for the pull coil. The PCB functions as an internal timer that switches the pull coil ON and OFF so that the solenoid does not burn itself out.

**Features:**
- Totally encapsulated PCB ensures reliability in the harshest environments
- Compact design for usage in tight spaces
- Reverse polarity protected

**DIMENSIONS**

Dimensions in brackets are millimeters.
Advanced Integrated Coil Electronics (AICE)
For Single Coil Solenoids

Electronics integrated into a single coil solenoid control the solenoid’s current to provide high initial starting force and a constant hold force. The microprocessor encapsulated onto the solenoid calculates the pull time and then generates a pulse width modulated signal to create the hold coil function for single coil solenoids. Under this reduced current, the hold force of the plunger is held constant over input voltage and temperature ranges.

Features:
• Totally encapsulated electronics operate on PWM signals to regulate current
• Compact design for usage in tight spaces
• Reverse polarity protected

Dimensions in brackets are millimeters.
We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 36585.