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# Application of electrical coils, ***XT*** IEC contactors from 250 A to 2000 A

Frame L

Frame M

Frame N

Frame P

Frame R

## Introduction

The Frame L–R XTCE contactors (XTCE250L to XTCEC20R) have a unique coil design, giving customers more options when designing their control scheme in a control panel. The electronic coil in the XTCE allows for more control design flexibility, increased safety of design, reduced panel space requirements and panel costs, reduced installation effort, and reduced energy consumption.

## Design flexibility and increased safety

The ***XT*** contactor with electronic coil offers a variety of control schemes to provide flexibility in control design. The ***XT*** contactor with electronic coil can be controlled directly from a PLC, an LCCD (low-consumption command device), or by using a traditional control scheme. Through direct control from a PLC or an LCCD, it is possible to eliminate the need for a control power transformer and an interposing relay, which simplifies the overall design. See **Table 1** for the wiring schematics for the various control options of the ***XT*** contactor with electronic coil. Note that the safety/emergency stop connection is located in the A1–A2 terminal line. This is done to ensure that power is removed from the contactor coil if the safety/emergency stop is activated.

In addition to flexible control wiring options, the XTCE electronic coil also provides the ability to enhance control panel safety through the use of low voltage control for large contactor applications. Traditionally, low voltage, such as 24 Vdc, could not be used to control a large contactor because a large amount of current is required to pull in the contacts on a standard coil design. For example, suppose the power consumption to close a 400 A contactor with a standard coil design is 850 W:

$W = V \times I_{pickup}$
$850\ W = 24\ V \times I_{pickup}$
$I_{pickup} = 850\ W / 24\ V$
$I_{pickup} = 35.4\ A$

High amperage in the control circuit creates issues in the control design, such as dealing with larger gauge wire and the introduction of other control components, such as an interposing relay. For this reason, many panels with large contactors use a higher control voltage or a dual control voltage, instead of a more safe low voltage design. The electronic coil on the ***XT*** contactor allows users to design their panel with low voltage control and no interposing relays.

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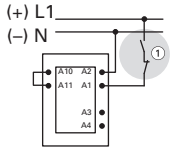
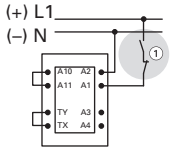
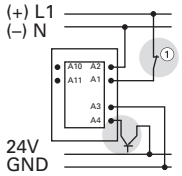
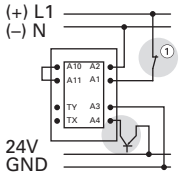
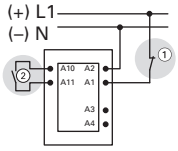
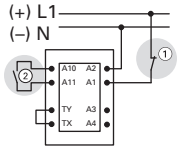
**Table 1. XTCE contactors frame L–R control options**

| Description | XTCE250L–XTCEC14P | XTCEC16R, XTCEC20R |
|---|---|---|
| **Conventional**<br>A1/A2 are applied to voltage in the usual manner. |  |  |
| **Direct from the PLC**<br>A 24 V output from the PLC can be connected directly to connections A3/A4.<br>  |  |  |
| ***From low-consumption command devices***<br>Command devices that can only be subject to minimal loads such as circuit board relays, control circuit devices, or position switches can be connected directly to A10/A11. |  |  |

① Standstill in an emergency (emergency stop).

② Command-device connection.

## Reduced panel space and installation effort

When wiring the ***XT*** contactor for direct control by a PLC or an LCCD, the coil can be powered directly from the power circuit instead of the control circuit. This means that a control power transformer is no longer needed to power the coil. Removal of a control power transformer from the control design clears space in the panel and may permit use of a smaller, less expensive panel. No control power transformer also means no associated wiring, translating into faster control panel manufacturing and less chance of a wiring mistake. **Table 2** compares the XTCE with typical power consumption of a standard contactor and the size of a typical control power transformer needed to power the coil.

Additionally, the electronic coil design allows for a compact coil design, which in part makes the XTCE contactor smaller in size.

## Reduced energy consumption

As a general rule, the mass of a contactor is a function of the contactor capacity. And as the contactor mass increases, more energy is required to pull in the contactor. Conventional coil designs are not exempt from this rule. However, as shown in **Table 2**, the XTCE contactor with electronic coil requires significantly less energy to operate compared to a contactor with a conventional coil design. For example, compare power requirements of a standard coil design and the ***XT*** electronic coil at 120 Vac for a 300 A AC-3 rated contactor:

Typical Pickup VA for a standard coil design (300 A contactor) = 1100

1100 VA = 120 V x $I_{pickup}$

$I_{pickup}$ = 1100 VA / 120 V

$I_{pickup}$ = 9.17 A

XTCE400M Pickup VA = 250

250 VA = 120 V x $I_{pickup}$

$I_{pickup}$ = 250 VA / 120 V

$I_{pickup}$ = 2.08 A

Typical Sealing VA for a standard coil design (300 A contactor) = 35

35 VA = 120 V x $I_{sealing}$

$I_{sealing}$ = 35 VA / 120 V

$I_{sealing}$ = 292 mA

XTCE400M Sealing VA = 4.3

4.3 VA = 120 V x $I_{sealing}$

$I_{sealing}$ = 4.3 VA / 120 V

$I_{sealing}$ = 36 mA

In this example, the ***XT*** electronic coil requires 1/4 of the power to engage the contacts and 1/8 of the power to maintain contact closure.

**Table 2. Typical consumption of a non-electronic coil and the XTCE and size of typical control power transformer (CPT) needed to power the coil** ①

| Contactor Size (AC-3) | 250 | 300 | 400 | 500 | 650 | 750 | 820 | 1000 |
|---|---|---|---|---|---|---|---|---|
| Typical pickup VA | 1100 | 1100 | 980 | 975 | 1360 | 1450 | 1450 | 2200 |
| Typical sealing VA | 35 | 35 | 15 | 15 | 20 | 20 | 20 | 25 |
| CPT height (in) | 5-3/4 | 5-3/4 | 5-3/4 | 5-3/4 | 6-1/2 | 6-1/ | 6-1/2 | 7-1/2 |
| CPT width (in) | 6-3/4 | 6-3/4 | 6-3/4 | 6-3/4 | 7-1/2 | 7-1/2 | 7-1/2 | 9 |
| CPT depth (in) | 7 | 7 | 7 | 7 | 7-1/2 | 7-1/2 | 7-1/2 | 7-3/4 |

| XT Contactors | XTCE250L | XTCE300L | XTCE400M | XTCE500M | XTCE650N | XTCE750N | XTCE820N | XTCEC10N |
|---|---|---|---|---|---|---|---|---|
| Pickup VA | 250 | 250 | 250 | 250 | 800 | 800 | 800 | 800 |
| Sealing VA | 4.3 | 4.3 | 4.3 | 4.3 | 7.5 | 7.5 | 7.5 | 7.5 |
| CPT height (in) | | | | | | | | |
| CPT width (in) | | | | Not required when using direct control from PLC or LCCD | | | | |
| CPT depth (in) | | | | | | | | |

① Typical power consumption values are derived using data from competitive products with conventional coil designs.

## Conclusion

The Frame L–R XTCE contactors (XTCE250L to XTCEC20R) provide the flexibility to allow users to design their control panels with optimal safety while minimizing material, manufacturing, and energy costs.

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