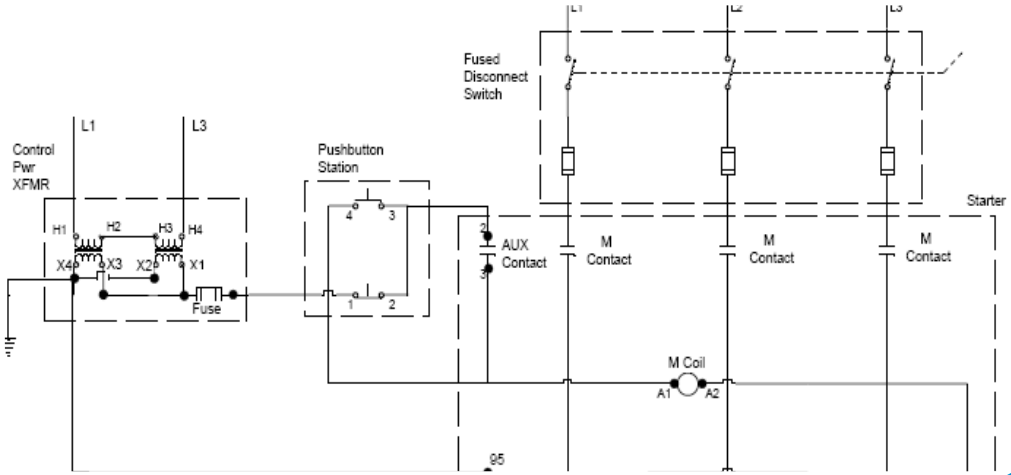
Crash Course on How to Read Electrical Schematics



Presenter Marty Redman

The Keys to Reading Drawings

- ✓ Understanding how Electricity Works.
- ✓ The different types of Drawings.
- ✓ Knowing your Symbols and Abbreviations.
- ✓ Understanding how the Devices operate in the circuit.
- ✓ Checking the Title Block.
- ✓ Checking for Key Notes and Updates to the Drawing.
- ✓ Understanding the difference between NEMA and IEC Drawings.

Understanding how Electricity Works.

The 4 things that every circuit must have to work!

1. **Source of energy; we usually get our energy from a breaker or fuse (OCPD) in a distribution panel or disconnect.**

2. **Resistance/Load; this is usually something that does work for us like (motors, heaters, etc.).**

3. **Current (Ampere) is the flow of electrons.**

4. **Complete path; this is created with the conductor (wires) we use to connect the devices together.**

The Different Types of Drawings

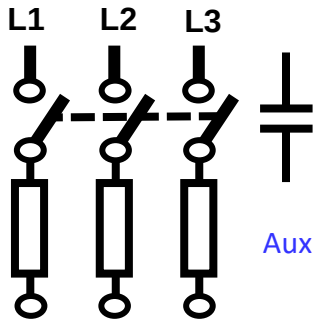
1. **Single-line diagrams** — **Distribution flow**
2. **Wiring diagrams** — **Location of terminations**
3. **Schematic diagrams** — **Electrical operation**
4. **Ladder diagrams** — **Control circuits**
5. **Floor plans** — **Branch circuit and wiring**
6. **Site plans** — **Overview of your facility**

Knowing your Symbols and Abbreviations

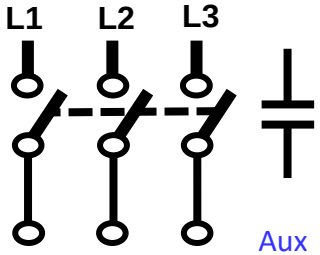
- **Each discipline (Arch, Mech, Elec, Plumbing, Civil, Structural, Landscaping) has its own set of symbols and abbreviations.**
- **Most drawings will have a Legend Sheet with this information on it.**
- **You must know what the symbols mean, or you can't trouble shoot.**
- **Two types of Electrical Symbols Power and Controls**

Some Power Symbols

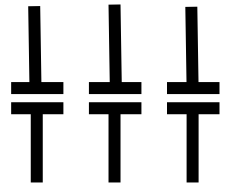
Fused Disconnect SW



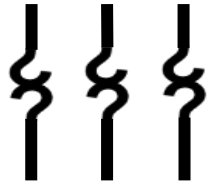
Non-Fused Disconnect SW



Contactor



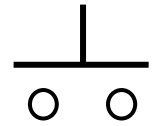
Overloads



Knowing your Symbols and Abbreviations

- **Two types of Electrical Symbols Power and Controls**

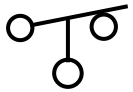
Some Control Symbols



NO Push Button Momentary

NC Push Button Momentary

NO Limit SW



NC Float SW

Pilot light
Letter in circle indicates color of lens

Coil
Letter in circle indicates type of device

Solenoid coil

NO Relay Contact

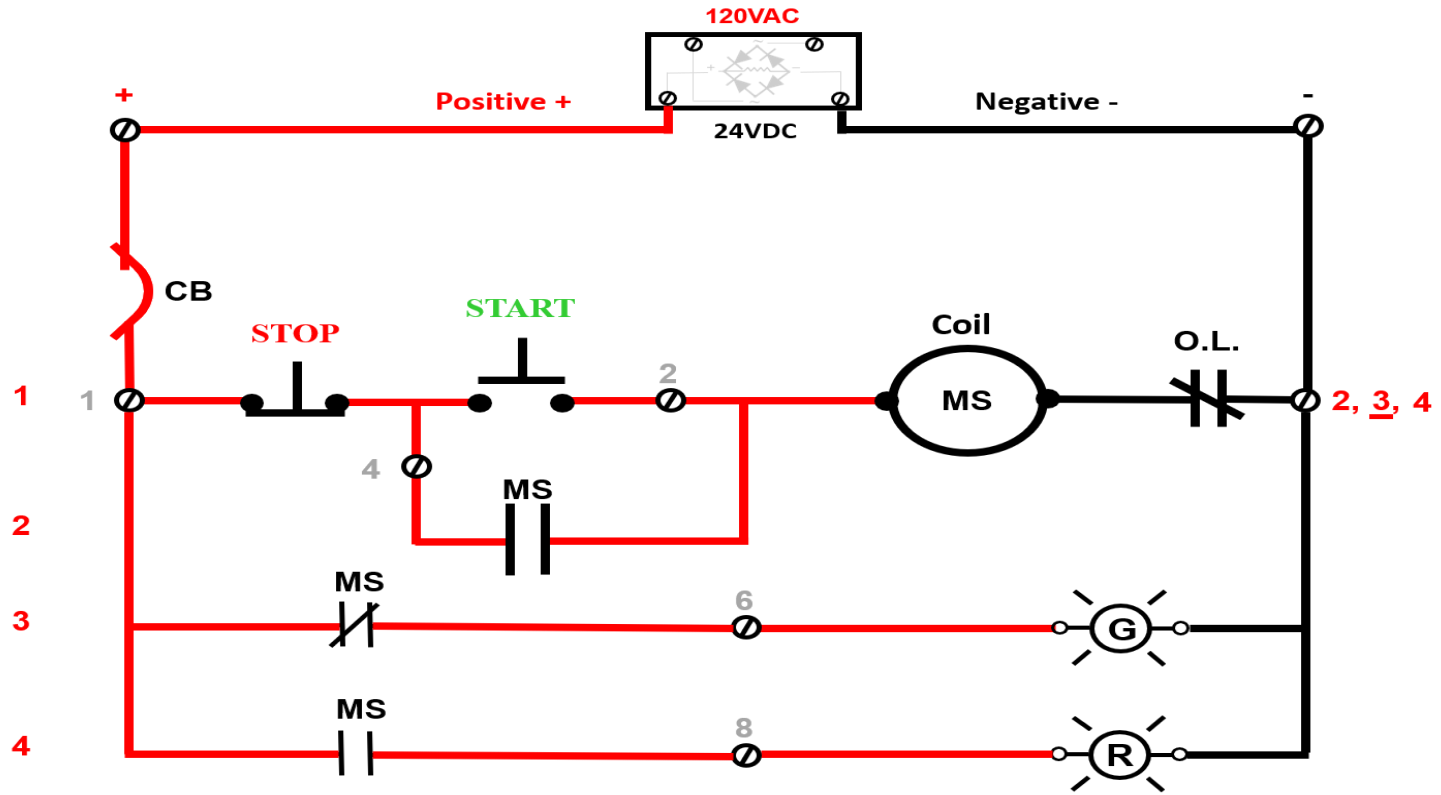
NC Relay Contact

Remember Most drawing are drawn in the de-energized state!

What does this mean?

Ladder Diagram

A ladder diagram is showing us just the logic (the path the current takes) and not where any devices are or there ratings.
Some may show termination points as this one does.
Ladder diagrams are read from top to bottom, left to right



IEC

IEC Prints

What do the numbers all Mean

A7-02K11

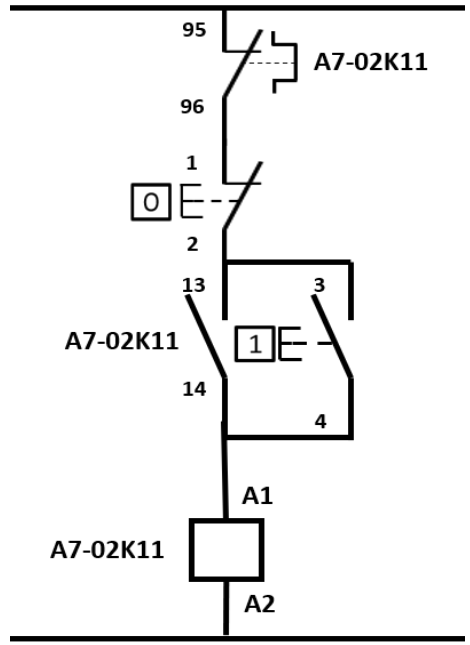
Print Group → **A7**-02K11

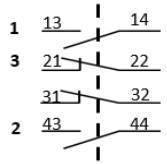
Print Page → A7-**02**K11

Type of Device → A7-02**K**11 → Relay or contactor

Rung or Space Number → A7-02K**1**1

Number of Loads in Space → A7-02K1**1**





Maschinenbezeichnung			⇦ A7-01
		+5	⇨ A7-03
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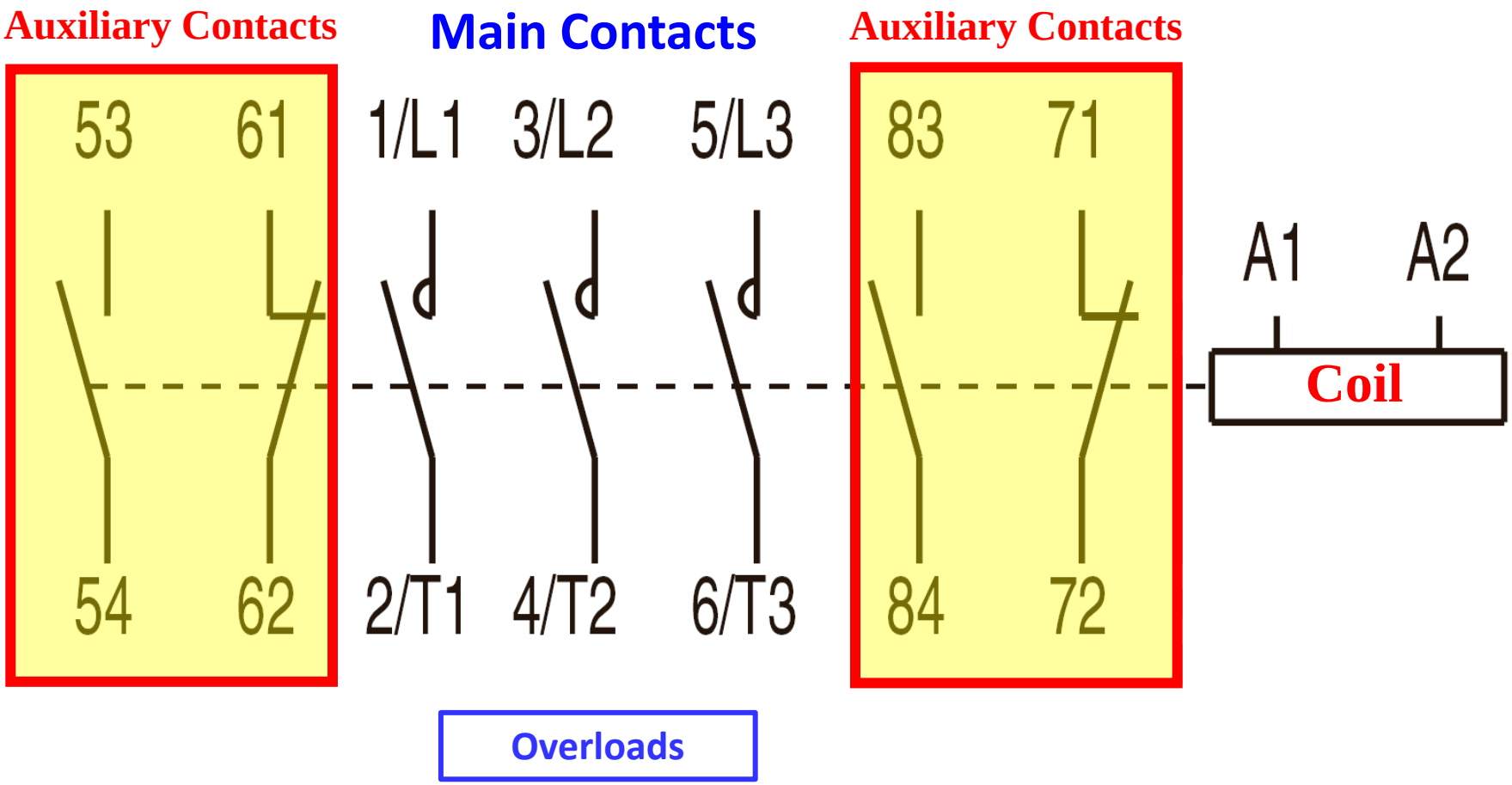
IEC Contactor

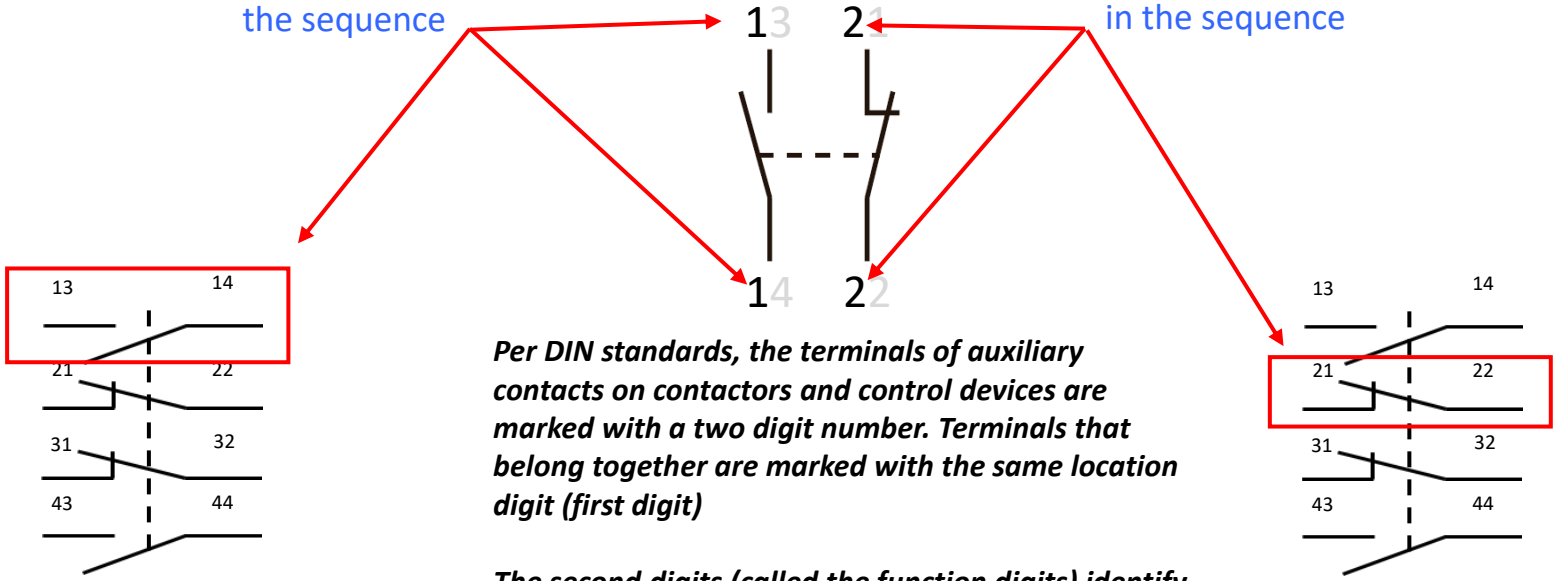


IEC Relay

Type of contact	Function digits
Normally Open	3 and 4
Normally closed	1 and 2
Normally Closed (Special Function)	5 and 6 i.e. Time-Delay or Overload
Normally Open (Special Function)	7 and 8 Overload Contacts

1 identifies first contact in the sequence

2 identifies second contact in the sequence



Per DIN standards, the terminals of auxiliary contacts on contactors and control devices are marked with a two digit number. Terminals that belong together are marked with the same location digit (first digit)

The second digits (called the function digits) identify the function of each contact per the following designation.

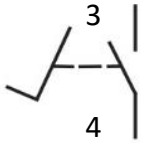
IEC Symbols

Type of contact	Function digits
Normally Open	3 and 4
Normally closed	1 and 2

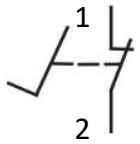
Limit (NC)

Limit (NO)

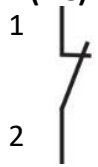
Foot (NO)



Foot (NC)

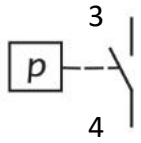


Relay Contact (NC)

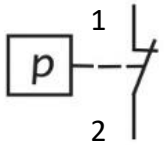


Relay Contact (NO)

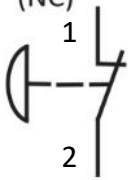
Pressure (NO)



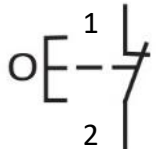
Pressure (NC)



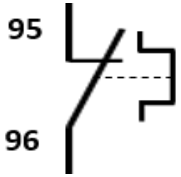
Mushroom Head (NC)



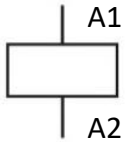
Push Button Momentary (NC)



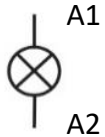
Overload Contact



Contactor Coil



Pilot Light



IEC Ladder Diagram

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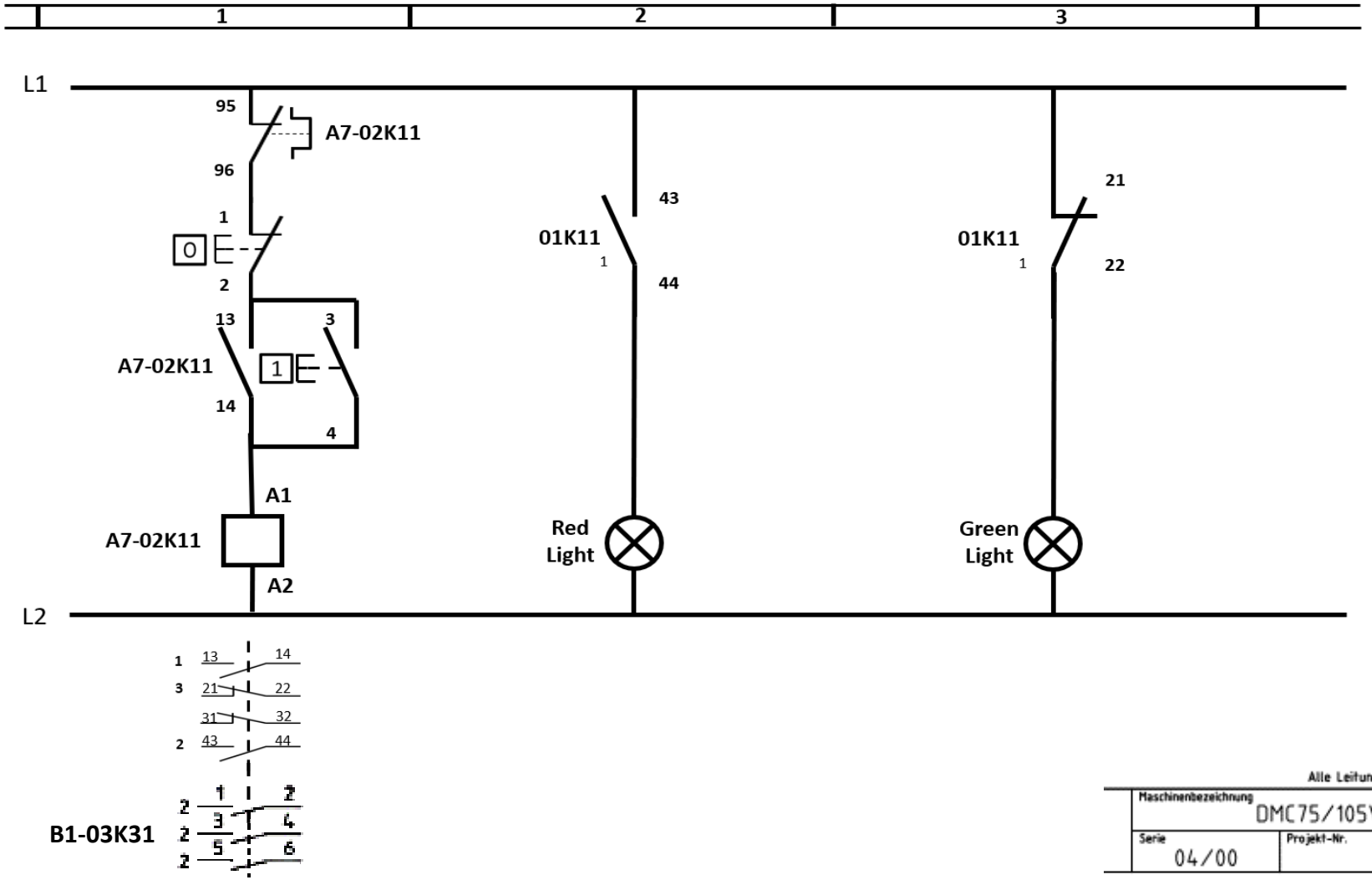
IEC Ladder diagrams are read from left to right, and top to bottom.



NEMA

Alle Leitungen ohne Querschnittsangabe sind H05V BU 0,75 mm²

Maschinenbezeichnung: DMC75/105Vlin. iTNC		⇦	A7-01
	+S	⇨	A7-03
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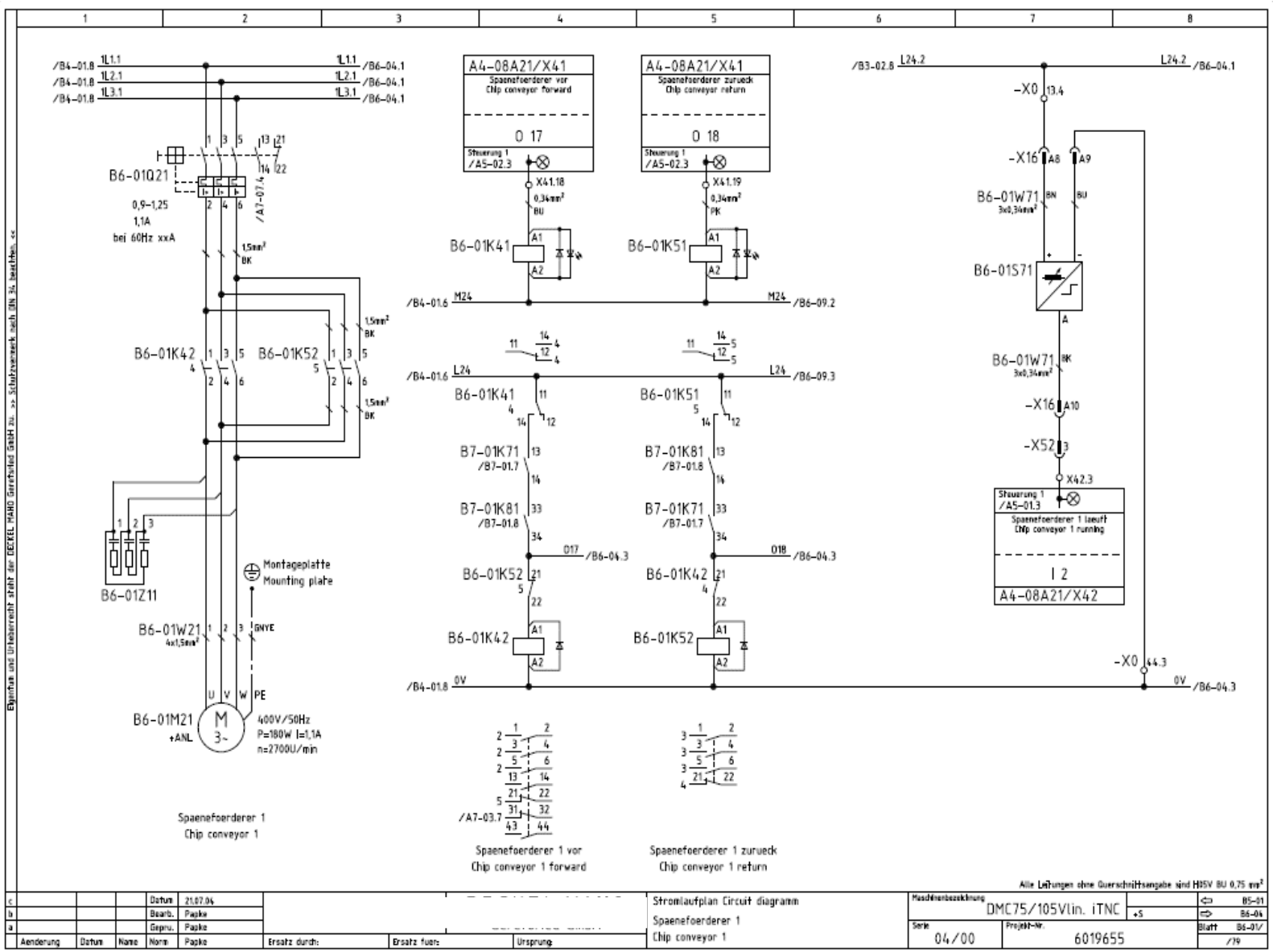
IEC Ladder Diagram



Questions?

- If you'd like to learn more about electrical schematics, TPC Training can help!

Email: sales@tpctraining.com

Phone: (847) 808-4000

Thank you for your time today!

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Remember we should never stop learning!