

# DL105 Instruction Set

## Boolean Instructions

- Store (STR)**  
Begins a new rung or an additional branch in a rung with a normally open contact.
- Store Not (STRN)**  
Begins a new rung or an additional branch in a rung with a normally closed contact.
- Or (OR)**  
Logically ORs a normally open contact in parallel with another contact in a rung.
- Or Not (ORN)**  
Logically ORs a normally closed contact in parallel with another contact in a rung.
- And (AND)**  
Logically ANDs a normally open contact in series with another contact in a rung.
- And Not (ANDN)**  
Logically ANDs a normally closed contact in series with another contact in a rung.
- And Store (ANDST)**  
Logically ANDs two branches of a rung in series.
- Or Store (ORST)**  
Logically ORs two branches of a rung in parallel.
- Out (OUT)**  
Reflects the status of the rung (on/off) and outputs the discrete (on/off) state to the specified image register point or memory location.
- Or Out (OR OUT)**  
Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program.
- Positive Differential (PD)**  
Is typically known as a one shot. When the input logic produces an off to on transition, the output will energize for one CPU scan.
- Set (SET)**  
An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) OFF that were set ON with the set instruction.
- Reset (RST)**  
An output that resets a point or a range of points.
- Pause Outputs (PAUSE)**  
Disable the update for range of specified output points.

## Accumulator/Stack Load and Output Data

- Load (LD)**  
Loads a 16 bit word into the lower 16 bits of the accumulator / stack.
- Load Double (LDD)**  
Loads a 32 bit word into the accumulator / stack.
- Load Formatted (LDF)**  
Loads the accumulator with a specified number of consecutive discrete memory bits.
- Load Address (LDA)**  
Loads the accumulator with the HEX value for an octal constant (address).
- Out (OUT)**  
Copies the values in the lower 16 bits of the accumulator to a specified V memory location.
- Out Double (OUTD)**  
Copies the value in the accumulator to two consecutive V memory locations.
- Out Formatted (OUTF)**  
Outputs a specified number of bits (1-32) from the accumulator to the specified discrete memory locations.
- Pop (POP)**  
Moves the value from the first level of the accumulator stack to the accumulator and shifts each value in the stack up one level.

## Comparative Boolean Instructions

- Store if Equal (STRE)**  
Begins a new rung or additional branch in a rung with a normally open equal contact. The contact will be on when A = B.
- Store If Not Equal (STRNE)**  
Begins a new rung or additional branch in a rung with a normally closed equal contact. The contact will be on when A ≠ B.
- Or if Equal (ORE)**  
Connects a normally open equal contact in parallel with another contact. The contact will be on when A = B.
- Or if Not Equal (ORNE)**  
Connects a normally closed equal contact in parallel with another contact. The contact will be on when A ≠ B.
- And if Equal (ANDE)**  
Connects a normally open equal contact in series with another contact. The contact will be on when A = B.
- And if Not Equal (ANDNE)**  
Connects a normally closed equal contact in series with another contact. The contact will be on when A ≠ B.
- Store (STR)**  
Begins a new rung or additional branch in a rung with a normally open comparative contact. The contact will be on when A ≥ B.
- Store Not (STRN)**  
Begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when A < B.
- Or (OR)**  
Connects a normally open comparative contact in parallel with another contact. The contact will be on when A ≥ B.
- Or Not (ORN)**  
Connects a normally closed comparative contact in parallel with another contact. The contact will be on when A < B.
- And (AND)**  
Connects a normally open comparative contact in series with another contact. The contact will be on when A ≥ B.
- And Not (ANDN)**  
Connects a normally closed comparative contact in series with another contact. The contact will be on when A < B.

## Timer, Counter, and Shift Register Instructions

- Timer (TMR)**  
Single input incremental timer with 0.1 second resolution (0-999.9 seconds).
- Fast Timer (TMRF)**  
Single input incremental timer with 0.01 second resolution (0-99.99 seconds).
- Accumulating Timer (TMRA)**  
Two input incremental timer with 0.1 second resolution (0-9,999,999.9 sec.). Time and enable/reset inputs control the timer.
- Accumulating Fast Timer (TMRFA)**  
Two input incremental timer with 0.01 second resolution (0-999,999.99 sec.). Time and enable/reset inputs control timer.
- Counter (CNT)**  
Two input incremental counter (0-9999). Count and reset inputs control the counter.
- Stage Counter (SGCNT)**  
Single input incremental counter (0-9999). RST instruction must be used to reset count.
- Up Down Counter (UDC)**  
Three input counter (0-99999999). Up, down, and reset inputs control the counter.
- Shift Register (SR)**  
Shift data through a range of control relays with each clock pulse. The data, clock, and reset inputs control the shift register.

## Immediate Instructions

- Store Immediate (STRI)**  
Begins a rung/branch of logic with a normally open contact. The contact will be updated with the current input field status when processed in the program scan.
- Store not Immediate (STRNI)**  
Begins a rung/branch of logic with a normally closed contact. The contact will be updated with the current input field status when processed in the program scan.
- Or Immediate (ORI)**  
Connects a normally open contact in parallel with another contact. The contact will be updated with current input field status when processed in the program scan.
- Or Not Immediate (ORNI)**  
Connects a normally closed contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.
- And Immediate (ANDI)**  
Connects a normally open contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.
- And Not Immediate (ANDNI)**  
Connects a normally closed contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.
- Or Out Immediate (OROUTI)**  
Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program. The output field device status is updated when the instruction is processed in the program scan.
- Set Immediate (SETI)**  
An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) off that were set. The output field device status is updated when the instruction is processed in the program scan.
- Reset Immediate (RSTI)**  
An output that resets a point or a range of points. The output field device status is updated when the instruction is processed in the program scan.

## Logical Instructions (Accumulator)

- And (AND)**  
Logically ANDs the lower 16 bits in the accumulator with a V-memory location.
- And Double (ANDD)**  
Logically ANDs the value in the accumulator with two consecutive V-memory locations or an 8-digit constant.
- Or (OR)**  
Logically ORs the lower 16 bits in the accumulator with a V-memory location.
- Or Double (ORD)**  
Logically ORs the value in the accumulator with two consecutive V-memory locations or an 8-digit constant.
- Exclusive Or (XOR)**  
Performs an Exclusive Or of the value in the lower 16 bits of the accumulator and a V memory location.
- Exclusive Or Double (XORD)**  
Performs as Exclusive Or of the value in the accumulator with two consecutive V memory locations or an 8-digit constant.
- Compare (CMP)**  
Compares the value in the lower 16 bits of the accumulator with a V-memory location.
- Compare Double (CMPD)**  
Compares the value in the accumulator with two consecutive V-memory locations or an 8-digit constant.

## Math Instructions (Accumulator)

- Add (ADD)**  
Adds a BCD value in the lower 16 bits in the accumulator with a V-memory location. The result resides in the accumulator.
- Add Double (ADDL)**  
Add a BCD value in the accumulator with two consecutive V-memory locations or an 8-digit constant. The result resides in the accumulator.
- Subtract (SUB)**  
Subtract a BCD value, in a V memory location from the lower 16 bits in the accumulator. The result resides in the accumulator.
- Subtract Double (SUBD)**  
Subtract a BCD value, which is either two consecutive V-memory locations or an 8-digit constant, from a value in the accumulator. The result resides in the accumulator (continued below).

- Multiply (MUL)**  
Multiplies a BCD value, which is either a V-memory location or a 4-digit constant, by the value in the lower 16 bits in the accumulator. The result resides in the accumulator.
- Divide (DIV)**  
Divides a BCD value in the lower 16 bits of the accumulator by a BCD value which is either a V-memory location or a 4-digit constant. The result resides in the accumulator.
- Increment Binary (INCB)**  
Increments a binary value in a specified V-memory location by 1 each time the instruction is executed.
- Decrement Binary (DECB)**  
Decrements a binary value in a specified V-memory location by 1 each time the instruction is executed.

## Table Instructions

- Move (MOV)**  
Moves the values from one V-memory table to another V-memory table.
- Move Memory Cartridge/Load Label (MOVMC/LDLBL)**  
Copies data from data label area in program ladder memory to V-memory.

## Bit Instruction (Accumulator)

- Shift Left (SHFL)**  
Shifts the bits in the accumulator a specified number of places to the left.
- Shift Right (SHFR)**  
Shifts the bits in the accumulator a specified number of places to the right.
- Encode (ENCO)**  
Encodes the bit position set to 1 in the accumulator, and returns the appropriate binary representation in the accumulator.
- Decode (DECO)**  
Decodes a 5-bit binary value (0-31) in the accumulator by setting the appropriate bit position to 1 in the accumulator.

## Interrupt Instructions

- Interrupt Routine / Return (INT / IRT)**  
When a hardware or software interrupt occurs the interrupt routine will be executed. The INT instruction is the beginning of the interrupt routine. The interrupt routine is terminated with an IRT instruction (unconditional interrupt return). When an interrupt return is reached the execution of the program continues from the instruction where the program execution was prior to the interrupt.
- Enable Interrupt (ENI)**  
Enable hardware and software interrupt to be acknowledged.
- Disable Interrupt (DISI)**  
Disable hardware and software interrupt from being acknowledged.

## CPU Control Instructions

- No Operation (NOP)**  
Inserts a N.O. operation coil at specified program address.
- End (END)**  
Marks the termination point for the normal program scan. An End instruction is required at the end of the main program body.
- Stop (STOP)**  
Changes the mode of the CPU from Run to Program (Stop).

## Number Conversion Instructions (Accumulator)

- Binary (BIN)**  
Converts the BCD value in the accumulator to the equivalent binary value. The result resides in the accumulator.
- Binary Coded Decimal (BCD)**  
Converts the binary value in the accumulator to the equivalent BCD value. The result resides in the accumulator.
- Invert (INV)**  
Takes the one's complement of the 32-bit value in the accumulator. The result resides in the accumulator.

## RLPLUS Stage / Drum Programming/

- Stage Instructions:**
- Initial Stage (ISG)**  
The initial stage instruction is used for a starting point for user application program. The ISG instruction will be active on power up and PROGRAM to RUN transitions.
- Stage (SG)**  
Stage instructions are used to create structured program. They are program segments which can be activated or deactivated with control logic.
- Jump (JMP)**  
N.O. coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.
- Master Line Set/Master Line Reset (MLS/MLR)**  
Allows the program to control sections of logic by forming a new power rail. The MLS marks the beginning of a power rail and the MLR marks the end of the power rail control.
- Drum Instructions: Time and Event Drum with Discrete Outputs (EDRUM)**  
Time and/or event driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in ms). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

## Message Instructions

- Fault/Data Label (FAULT/DLBL)**  
Displays a V-memory value or a Data label constant to the hand-held programmer or personal computer using DirectSOFT.
- Numerical Constant/ASCII Constant (NCON/ACON)**  
Stores constants in numerical or ASCII form for use with other instructions.