drive.web smarty⁷ ®

Universal Automation Controller

models

dw250, dw254, dw258, & dw259

Installation & Operation Manual

Contents	Page

Design Statements

This process control equipment to be supplied by Class2, LPS, limited power supply.

EMC Standard, EN 61326-1: 2006, Electrical Equipment for Measurement, Control and Laboratory Use.
Emissions Class A, Commercial Equipment.
Immunity Table 2, Industrial Equipment.

LVD Standards, EN 61010-1: 2010, Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use and;
EN 61010-2-030: Particular Requirements for Testing and Measuring Circuits.

smarty is an industrial controller designed for permanent installation by qualified professionals. If it is used in a manner not specified herein the protection provided may be impaired.

smarty and its packaging contain recyclable materials

This device is designed to comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1)This device may not cause harmful interference, and (2)this device must accept any interference received, including interference that may cause undesired operation.

This Class [A] digital apparatus is designed to comply with Canadian ICES-003. Cet appareil numerique de la classe [A] est conforme à la norme NMB-003 du Canada.

⚠ **Warning!** It is essential that you read and understand this entire manual and the entire contents of the *savvy* software *Help* menu before proceeding with your installation and configuration. See page 6 for *savvy* installation instructions. For more information and to download manuals and software, go to *www.driveweb.com* or contact us. See page 12.

⚠ **Warning!** Your use of *savvy* software and *drive.web* devices may cause motors and machinery to power up with high Voltages or start or operate in an unexpected, dangerous or lethal way. It is essential that you are completely familiar with all of the equipment and the system design before attempting to program or edit a program or connect to any live device. It is also essential that a risk assessment is conducted to identify hazards. Risks must be reduced to tolerable levels.

⚠ **Warning!** You are entirely responsible for the configuration or use of any *drive.web* product. By configuring or using these products you agree to indemnify and hold harmless Bardac Corporation, its employees, directors, officers, distributors, and resellers against the consequences of your configuration or use of the products.

⚠ **Warning!** Information in this manual is subject to change without notice. You are responsible for verifying the proper operation of your *smarty*. Special care must be taken after loading new firmware or installing new options.

SMARTY, SAVVY, SAVVYPANEL, SPEEDY, BARDAC, and DRIVE.WEB are trade marks of Bardac Corporation, registered in the U.S. and other countries.

⚠️ **Warning!** Avoid permanent damage to your *smarty*, never exceed any **min** or **max** values. Do not connect any *smarty* terminal to mains circuits. See page 5 for IO ratings.

Product Identification - *smarty⁷*

The *smarty⁷ dw25x* Series are Universal Automation Controllers (*UAC*) Find *smarty* model and firmware version. Use *savvy*, *Get Detailed Info* from *smarty* contextual menu. See page 6.

Product Identification - Part Numbers

Model number *dw25x* is appended with a three character extension.

Example; **dw250-DM-S7**

Model   Build Standard   ModbusRTU Type   XIO Build

smarty Cassette Models

dw250 Universal Automation Controller, (UAC).
dw254 UAC for *P2* industrial vector drive.
dw258 UAC for *E3* open-loop vector drive.
dw259 UAC for *CANopen* server devices.

Standard Builds *A, B, C,* and *D* - Software Options

A=04 and 26, *B* adds 05 and 25, *C* adds 06 and 39, *D* adds 10 and 29.
04 ModbusTCP/IP - Server-slave. See page 12.
05 Process Control - Recommended for most applications.
06 Winder Control - Diameter Calc., Taper Tension, Torque Comp.
10 Math - With advanced math functions.
25 EIP/PCCC - Slave/server. See page 12.
26 savvyPanel - Operator station interface. See pages 8, 9.
29 Solar - Calculates sun position azimuth and zenith.
39 Precision Motion - With event, length, position, shaft-lock, indexing, motion control, cam profile, and more. Page 12.

ModbusRTU Type, Options *M, S, X*

M - ModbusRTU Client-Master with speeds up to 500kbps. See page 12
S - ModbusRTU Server-Slave. Read or write any parameter in the device remotely. See page 12.
X - No ModbusRTU capability.

XIO Build *S7, HV, CL, XD*

S7 - Standard, no XIO option installed.
HV - Ten Digital Inputs, presets for 24VAC, 120VAC, or 240VAC. Six Digital Outputs, 24VAC to 240VAC, 0.5A with ZVS.
CL - Sixteen 4-20mA inputs. Eight 4-20mA outputs. Eight 24VDC digital outputs/inputs, 300mA shared.
XD - Sixteen digital inputs, 5V or 24V logic. Sixteen digital outputs/inputs, 24V sourcing, two 300mA shared banks.

smarty Installation

smarty is designed for permanent installation by qualified professionals.

Install *smarty* in metal enclosure with no RF noise source.

DIN rail mounting - Use 35x7.5mm rail per IEC 60715 or EN50022.

Environment - UL/IEC Pollution Degree 2.

    Operating temperature, 0°C min., 40°C max.

    Storage temperature, -20°C to 50°C.

    Altitude 3000m max.

    Humidity 95% max. non-condensing.

Clearances must be provided all around to promote airflow, 5mm (0.2") sides, 25mm (1") above and below.

smarty Terminal Naming and Ratings

● Terminal names are consistent in the *drive.web savvy* software, on the terminal, and on the cover plate next to the terminal.

24VDC and 0V Terminals are internally connected.
    Regulated DC Supply, 25.2Vmax, 22.8Vmin, 1A.
    External 1A fast-acting fuse or current-limiting is required!
    Do not connect to a distributed DC power network.
    Supply from Class 2, LPS, limited power supply, from within the same electrical enclosure, only.

AI - Analog inputs. -11VDC to +11VDC, 100kΩ, 1kHz, 16-bit. Also configurable for 5V or 24V logic digital input. 30V max.

AO - Analog outputs. Bipolar, -10.5VDC to +10.5VDC. 10mA.

DI - Digital inputs. 50VDCmax, 8VDC threshold, 3V hysteresis. 1kHz. Configurable as event inputs.

DO - Digital outputs. 24VDC source, up to 300mA, shared. Resistive, general use, and pilot duty. Overcurrent protection and software indication. Also configurable as digital inputs. Maximum Voltage is 25.2VDC.

1A+ - Example: Encoder 1 Channel A+. Differential or single-ended, incremental, quadrature encoder input. 24VDC max, -0.5VDC min., Up to 1MHz. *2A* and *2B* can be configured as marker inputs.

FT - Frequency, timing, event, stepper, or digital input and output. 30Vmax.
    Use *FI* function blocks for inputs 100kHz. Configurable for 24V logic or 5V logic with pull-up or pull-down. Configurable for frequency, counter, event, or digital input.
    Use *TO* function blocks for outputs. Configurable for stepper, frequency, or digital sinking output. 20mA, 500kHz max.

TO7 - Same as *FT TO* above but also configurable as a digital input and a unipolar analog input with settable range.

+5V Power supply output for use with encoders, sensors, etc, 250mA max.

smarty **Terminal Wiring**

Strip 7mm(0.28"). 1.5mm² (AWG16) max. One wire with ferrule, 0.8mm² (AWG18) maximum.

Use shielded cable for runs over 30 meters.

Fast transient over-Voltage 1kV per EN 61000-4-4.

Signal Wiring Notes

Use twisted-pair wiring for encoder and serial differential signals.

- Outside metal enclosure, use shielded cable with individually shielded twisted-pairs such as **Belden 8163**. Ground shield at one end with a 360° ground clamp where cable enters "quiet" metal enclosure.

- Separate wiring from AC power cables or RF noise sources.

smarty **Front Panel**

USB port - USB-C jack. Full/high speed. Can be used for backup power to maintain the real-time clock.

Ethernet port - MDI 8P8C, "RJ45" jack, 100baseTX and 10BaseT, Full Duplex, Auto Negotiation, Auto-MDIX, IEEE 802.3ab.

Indicator LEDs in front panel:

⏻ **Status** - Blue LED. Status heartbeat pulses twice a second.

⚠ **Fault** - Red LED indicates a fault. Check power supply, connect with *savvy*, or contact us at *drive.web* for more info.

⇌ **Ethernet link/activity** - Orange LED indicates Ethernet connection and blinks for activity.

100 **100BaseTX** - Green LED when connection is 100BaseTX.

smarty **DRIVE Serial Port**

- 6P6C Socket marked '10101'

- ModbusRTU EIA485. See page 12.

- CANbus connection for *dw254*, *dw258*, and *dw259*. See page 12. 1m max. cable length. Do not add termination resistors. These are built-in.

1 2 3 4 5 6

1 Modbus-, A
2 0V
3 CAN+
4 CAN-
5 0V
6 Modbus+, B
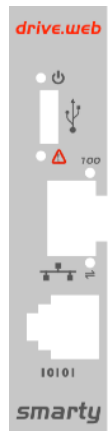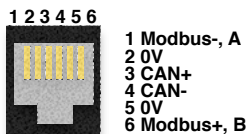
dw250 Dimensions, Overview, and Terminal Map

17.2mm (0.7")

90mm (3.5")

Eight Digital Outputs/Inputs

Eight Digital Inputs

5V, TO7, Six FT

119mm (4.7")

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CLOCK BATTERY

DO8 DO7 DO6 DO5 DO4 DO3 DO2 DO1 0V 24V

DI8 DI7 DI6 DI5 DI4 DI3 DI2 DI1 0V 24V

5V TO7 FT6 FT5 FT4 FT3 FT2 FT1 0V 24V

24V 0V AI1 AI2 AI3 AI4 AI5 AI6 AI7 AI8

24V 0V AO1 AO2 AO3 AO4 AO5 AO6 AO7 AO8

24V 0V 1A+ 1A- 1B+ 1B- 2A+ 2A- 2B+ 2B-

Eight Analog/Digital Inputs

Eight Analog Outputs

Two Incremental Encoders

Front Panel see page 4

Clock Battery CR2032 + side out

For clearances see Installation, page 3.

smarty Real-time Clock

- The real-time clock is only used for time of day and calendar functions. It can be set automatically by PTP to other drive.web devices, automatically upon discovery in the **drive.web savvy** software, per preferences, or via SNTP network time server protocol. See the **savvy** user manual for details.

- The real-time clock will be maintained for approximately 24hrs after supply power loss with no backup battery. Alternatively the clock can be powered by the USB port.

- Lithium button cell battery, CR2032, 3VDC, commonly found in convenience stores, is not provided from the factory due to shipping restrictions.

smarty Frequency Input Notes (FI Terminals)

FI Digital and Event Input Function Blocks

- Maximum event frequency is $1/(2*\text{FBE cycle (s)})$ Hz. E.g., for 5ms FBE cycle, the max event frequency is $1/10\text{ms} = 100\text{Hz}$.

- Use *Digital Input* function block *Input Type* parameter to configure;

FI Input Type	Threshold VDC	Threshold Min. VDC	Threshold Max. VDC
5V Logic with pull-down	2.0	1.0	3.0
5V Logic with pull-up	1.4	0.4	2.4
5V Logic	1.7	1.0	2.4
24V Logic with pull-down	8.4	5.0	11.8

FI Counter Inputs - Provide frequency data with adjustable moving-average filter and count outputs for use with motion control function blocks.

FI Frequency Inputs - Useful for lower frequencies ~<10kHz. Duty cycle is also measured. Updates every FBE cycle or two-edge cycle.

smarty Programming

Set up your computer - Get *savvy*

With free ***drive.web savvy*** software, easily program and monitor your ***smarty***, perform data trending, and create distributed control systems.

- Go to ***www.driveweb.com*** and click on *Get savvy*, or contact us to get the latest version of ***savvy.***

smarty USB - Plug and Play

Plug-and-play access to ***smarty*** **and** its local Ethernet network.

smarty Ethernet Networking & Programming

Assigning an invalid or duplicate IP address will cause serious network malfunctions!

- Find useful networking information. Under the ***Help*** menu click on ***Getting Started with savvy*** section.

- ***smarty***s are shipped with an IP address, 10.189.x.x, derived from the serial number. The six-octet serial number always starts with 0-4-bb-x. The last two octets are used to assign the as-shipped IP address; Example, if the serial number is 0-4-bb-00-1a-2b, 1a is converted from hexadecimal to decimal, 26. 2b, similarly, is 43, decimal. The as-shipped address is 10.189.26.43.

- Use *Category 5e* cable or better, with 8P8C/RJ-45 connectors for each ***drive.web*** device and the host computer.

- For systems with more than one ***drive.web*** device, use an Ethernet switch for all ***drive.web*** devices and computer.

Get started with *savvy*

- We strongly recommend attending our free online training seminars. See page 12.

- We strongly recommend you read the ***User Manual*** and ***Getting Started Guides*** under the ***Help*** menu.

- Use ***Create Phantom*** in the ***Directory*** menu to explore ***drive.web*** products and options, design, and configure offline. ***Export Data*** to save your work. ***Import Data*** into phantoms to work offline.

***savvy* Window Title Bar** indicates the current view.

Status Bar, above the viewing area, provides **Navigation Arrows** and object and location data.

- ***savvy*** views are hierarchical with the ***Device Directory View*** at top. Use the ***Navigation Arrows*** to go up, back, or forward. Window menus change as you navigate.

Hover cursor over active object, device, function block, connection, or parameter icon to view object information in the *Status Bar* and reveal a *Hover Button*.

Click a Hover Button or right-click an active object to access a *Contextual Menu*. See below.

savvy functions are limited by password-protected capability level. See *File > Capability…*

Device Directory Window

Warning! Changing a device IP address **WILL** disrupt its network connections! If a **smarty** is communicating with other devices, be prepared for system disruption. In the *File* menu choose *Utility > Remap Export File* to remap a *dw-system* file with different IP address(es).

- Select *File>Administrate>Set IP Addresses for System*.

- **smarty** serial number is also its *MAC Address*.

- Enter a valid IP address and click OK.

- An icon appears with IP address beneath. Drive-dedicated models depict the actual frame size of the drive.

- If the icon at right appears, a network connection problem exists. Check connections, LEDs, and that the **smarty** IP address is within the computer's Ethernet subnet mask.

10.189.189.189

Warning! Importing data into your **smarty** will result in immediate execution of that configuration. **Dangerous Voltages and rotating machinery may result!** Use a phantom to preview a configuration.

- *Directory > Import / Export Data.* All device configurations and connections in the directory in one *.dw-system* file.

smarty Icon Contextual Menu

- *Change Name* - Name your **smarty** for easy identification.

- *Import / Export Device Data...* - Load / save configuration data to / from this **smarty** only.

- *Unlock, Lock, Set Password* - Choose *Restrict Modification* to allow viewing the configuration, or *Restrict All Access*.

Click the smarty icon to view the device configuration.

Function Block Engine Window - FBE Menu

(Standard **savvy**, no **SFD**)

- Add function blocks in the order to be processed. Processing order is left to right, top to bottom.

Click function blocks to view parameters and details.

Connect between parameters and other *drive.web* devices.

Warning! Making a connection results in immediate execution of that connection. **Dangerous Voltages and rotating machinery may result!**

- Under the *File* menu, choose *New Viewer...* and then, *File > Open Device Directory*.

  - With two viewer windows, click a parameter, drag and drop onto a parameter in the other viewer.

Parameter Contextual Menu - Data is formatted, limited, and scaled depending on the parameter. Use *Get Info* or *Re-Scale...* to verify or change.

Click parameters for the Setter Box - Increment, decrement, default, last state, or keyboard entry.

Click blue connection block or arrow to jump to other end.

Upgrade *savvy* and *smarty*

Upgrade *savvy* with *SFD* **Signal Flow Diagram**.

Upgrade *smarty* with software options.

Process credit cards or *Vouchers* online or *Coupons* offline.

- To upgrade *savvy,* go to the *Commerce* menu, select *Upgrade savvy*, check desired options, click OK.

- To upgrade *smarty*, choose *Upgrade Device…* in its contextual menu, check desired options, click OK.

- To process *Vouchers*, choose *Pay > Online Via Vouchers* in the *Shopping Cart*. Enter *Voucher* codes on separate lines.

- To process *Coupons*, go to the *Commerce* menu and choose *Coupon Manager*. Enter codes in the top box and click the *Add* button and the coupon is recognized. Click *Apply*.

## *savvy-SFD* **Signal Flow Diagram Upgrade**

- With *savvy-SFD*, build systems graphically. The live drawings are stored in your *smarty*.

- Set drawing borders and annotate multi-page drawings.

- A filterable list of function blocks and connections is at the left of the *Signal Flow Diagram* showing **program execution order** from top down. Change execution order by dragging function blocks up or down the list. In this picture, *ENC1 Speed* function block is moved so that it is processed after *ENC Phase Lock*.
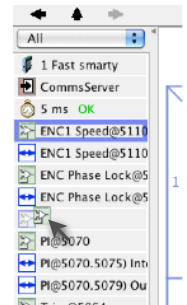
savvyPanel Operator Station

Computers, Apple®, and Android™ mobile digital devices are operator touch stations with **savvyPanel**. Requires Windows, Mac OS X, Linux-based Ubuntu, Android, or iOS®.

- Configurations are stored in the **drive.web** devices.

- **savvy-SFD** upgrade is required to edit or build **savvyPanel** systems.

- **dwOption-26 savvyPanel**, must be installed in **drive.web** devices to enable the full suite of tiles. A limited set is available without the option.
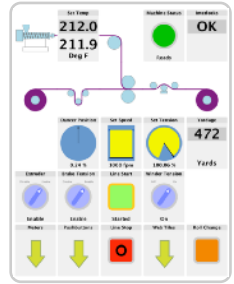
Get *savvyPanel* free from Apple App Store℠ and Google Play

- When your mobile digital device is connected to the internet via WiFi, demo mode connects to a live drive system in our plant in Maryland, USA.

- Explore the demo with **savvy**. Select *File > Demo Mode > Discover Internet Demo Devices savvyPanel* Pages

Systems Page where multiple *savvyPanel* systems are present.

- A **savvyPanel** system may contain tiles from many **drive.web** devices.

- A **drive.web** device contributes to only one **savvyPanel** system.

- Touch the systems button, or , in the window bar to access the systems page from home page. Lock this button with home password.

Home Page is the first operator page in a *savvyPanel* system.

- Access home page from any operator page with the home button, . Lock with the home password.

Operator Pages show graphic, page-link, and parameter tiles.

- Pages can be renamed. Page name appears in window title bar.

savvyPanel Tiles

Parameter Tiles - Touch a settable parameter to set. Setter includes slider, keypad, 1x and 10x increment and decrement, return-to-default, and revert.

Graphic Tiles - Create diagrams with process elements.

Page-Link Tiles - A graphic tile that is also a page-link. Touch to change the view to that page.

Device Tiles - Link to device's signal flow diagram in Java-based *savvyPanel*. Appears as graphic tile in iOS. **Function blocks enable *savvyPanel* actions**

Alarm Annunciator - Provides a system-wide alarm annunciation when active. Touch to view page 255.

Presence Monitor - Indicates the presence of a tagged *savvyPanel* application viewing a particular page.

Latch and *SR Latch* - For lighted start-stop pushbuttons.

Setpoint & *Monitor* - Adjust meter and setter range. Dual blocks enable dual-display meters.

Enumerated Parameter - In *Utility* group. Only custom enumerations appear in the setter and multi-position switch.

savvyPanel Launch, Setup, and Important Notes

- See the *savvy* user manual for detailed instructions.
- Launch *savvyPanel* via command line or batch file.
- Limit operators to *savvyPanel* only. Specify start system and page.
- Discover devices automatically, specifically by discovery file, or filtered by group and/or *savvyPanel* name.
- Operator's note: If communication with a *drive.web* device is interrupted, affected tiles indicate a yellow bar with a warning symbol. The tile is not updated.

Important Design Note - An over-range enumeration is required if an out-of-range value could cause a hazard.

smarty Precision Motion Parameters, Connections

Special parameter and connection types from I/O function blocks. Connections may also be over Ethernet to other *drive.web* devices without performance penalty.

Floating Point - IEEE-754 Binary32, wider range and resolution. Can be connected to or from standard, 16-bit parameters; 1.0000 float equals 100.00%.

Event - Events are associated with exact count values. Maximum event frequency is (1/(FBE Timebase seconds)) Hz. Only the first event is processed per FBE cycle.

Count - Position applications; shaft-lock, registration, motion control, etc. 64-bit internal values, precision timing data.
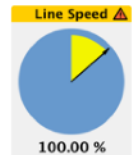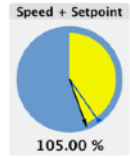
smarty Comms Interfaces-CANopen, Modbus, EIP/PCCC

Warning! Use of **smarty** comms interfaces may cause motors and machinery to energize with high Voltages, or start, or operate in unexpected, dangerous, or lethal ways.

- For Modbus specs go to http://modbus.org/specs.php

smarty Comms Server dwOption-O4 and -25

- **Note!** You cannot write or force parameters that are read-only or have incoming **drive.web** connections.
- Click the **Comms Server** icon in the **FBE** or **SFD** view.

dwOption-O4 ModbusTCP/IP slave/server

- Supported Modbus Function Codes; 1 thru 6, 15, and 16.
- Supports up to **five simultaneous clients/masters**.

dwOption-25 EIP/PCCC Server

- Supports PLC5 Typed-Write and Typed-Read commands.
- See Appendix B of the **savvy** User Manual for information and **drive.web** parameter IDs mapping to PLC5.
- Supports up to **two simultaneous clients**.

ModbusRTU

M=Master-Client, **S**=Slave-Server, **X**=None. See pages 2 and 4.

- Modbus Function Codes **FC 01** through **06** and **16** are supported. Also special Yaskawa Holding Register.
- Each server's Modbus address must be unique on the network!
- All devices on the network must have the same baud rate, up to 500.0kbps, and the same character framing.

dw259 Generic CANopen Master

- Dedicated to a single server device at speeds up to 1Mbps.
- 1m max cable length.
- Do not use termination resistors. These are built-in.
- Use **CANopen Setup** function block to configure.

drive.web Training Courses

Free online interactive training seminars take about one hour.

Specialized online and factory training sessions are also available.

To register email **training@driveweb.com** or call.