

# SEVERE DUTY (SD) CONTROL VALVES

COPIES VULCAN®



Copes-Vulcan has been providing control valves and desuperheaters for the power, process and nuclear industries since 1903. Copes-Vulcan provides a wide range of valves for the control of pressure, temperature and flow-induced noise in all types of power plants. Products include severe service and general service control valves, variable orifice desuperheaters, Raven™, trim and steam-conditioning valves and nuclear control valves, as well as custom designed specialty valves. Copes-Vulcan is recognized worldwide as a leader in valves for severe and critical service applications. Our strength lies in our ability to provide innovative valve solutions for our customers' application needs.



## SD SEVERE DUTY CONTROL VALVES

The SD-Severe Duty valve is Celeros's premium severe duty and critical service control valve design. The SD-Severe Duty line is the next generation of control valves designed specifically for severe duty applications. It is the preferred style of valve for applications such as pump recirculation, feedwater control and feedwater start-up, flashing or cavitating service, critical pressure drop gas and steam service, and any potentially noisy or vibration-prone service. It is also widely used for nuclear "N" stamp and seismic applications.

The SD-Severe Duty line incorporates a number of improvements such as:

Quick disconnect between valve stem and actuator yoke on most models that greatly simplifies service and inspection.

An extensive array of standard trims is available including many previously offered only as custom designs.

Shorter lead times/quicker delivery of both entire valve assemblies and replacement parts.

Improvements such as these, coupled with Celeros's innovative yet sound engineering practices, and a reputation for building the best control valves possible, assures that the SD-Severe Duty line is destined to become the new industry standard for severe duty and critical service applications.



For applications requiring pressure classes of 600 and below refer to Copes-Vulcan's GS Series valves.

### CAN BE EQUALLY EMPLOYED AS A TURBINE BYPASS VALVE OR STEAM LETDOWN STATION.

- Repeatable class V tight shutoff
- High pressure balanced
- Full plug guiding with anti-rotation
- Steam atomisation of the cooling water
- Low coolant pressure required
- High water capacity for large cooling duties
- High turndown ratio for both steam and water
- Noise attenuating trim options
  - Single stage HUSH
  - Multi stage HUSH
  - RAVEN
- Extremely flexible
  - Flanged or butt weld connections
  - ANSI 150 - 4500, standard, intermediate and split classes
  - Minimum straight line lengths required
- Low maintenance
- 'Quick-Change' trim design no special tools

The DSCV-SA (Direct Steam Converting Valve - Steam Atomization) from Celeros is designed for unprecedented operational reliability and eliminates potential risks associated with substandard designs during plant start-up, shutdown and turbine trips.

As a result, the DSCV-SA is at the forefront of modern thermodynamic engineering in steam conditioning.

Key to the DSCV-SA's performance are a number of unique technical innovations developed by Celeros following extensive consultation with customers in the power generation sector.

SD Series valves can be fitted with an extensive array of standard and high performance trims to meet most severe duty/critical service requirements. Copes-Vulcan specialty trims such as Raven™, Hush™, Soft-Seated Hush, Tandem and GAD™ are readily available to meet the most severe applications. Additionally, custom engineered trims are supplied by Celeros as required. All trims are of quick change design to assure ease of maintenance. Most are fully interchangeable between like sizes to ensure maximum flexibility and reduced inventory requirements.

The SD-style design is in accordance with ASME B16.1, B16.5, B16.11, B16.25, B16.34 and, when required, will comply with standards such as CAN Z299.2, .3 and .4, ASME SEC.I, ASME SEC.III, B31.1, PED-"CE", 'N' & 'NPT', 97/23/EC-PED-CE and is also ISO-9001 certified.



## TYPICAL PRODUCT APPLICATIONS

Feedwater Control



Condensate to Deaerator

Superheater Spray Control

Aux. Steam to Deaerator



Reheater Tank Drain to Condenser

Deaerator Water Level

Main Control



Boiler Water Tank to Condenser

Drum Level Control

Sootblower PRV



Continuous Blowdown

Boiler Feedpump

Min Flow Recirculation



HP Feedwater Start-Up Level Control Valve

**RAVEN™ TRIM**

Raven trim incorporates a unique advanced design that is superb at limiting flowing velocities to low levels resulting in valves providing service that is quiet, non-cavitating and non-erosive.

Raven's low velocities are achieved through the use of trim cage made by bonding together a series of individual discs. Each disc has a pattern of carefully controlled orifices and channels with a multitude of sharp turns etched into its surface. As the trim's plug travels within the cage the fluid is throttled and forced to travel an extremely torturous path with each turn effecting a stage of pressure drop.

The combined effect of numerous narrow flow channels, each with many sharp turns and a continually expanding flow path, removes kinetic energy from the fluid while gradually lowering its pressure. In doing so, abrupt velocity increases that are the source of noise are avoided. The additional benefit for liquid flow is the elimination of cavitation and the damage it can do to a valve, its trim and the downstream piping.

By its very design Raven trim allows for many more stages of drop than conventional torturous path trims.

Superior to other velocity control trims, Raven, through the use of a consistent narrow wall design, typically is more efficient at passing flow or allowing more turns or stages of drop in a given valve size.



ACTUAL GASEOUS FLOW THROUGH RAVEN TRIM.

Most Raven trims contain multiple relief points in the flow path as a standard feature. These relief points allow entrained debris to clear the main fluid flow, or in the case of significant path blockage, they provide an effective bypass route for the fluid.

With the benefits of the relief points, the actual fluid flow streams still remain virtually separate or discrete from each other for best velocity control.

By manufacturing the flow channels to extremely close tolerances, Raven's calculated or predicted versus actual pressure drops are significantly more accurate than competitors. Hence, velocities are more uniform throughout the entire trim, further guarding against noise, erosion and cavitation.

Ultimately, each Raven trim is specifically designed to provide the finest severe duty valve service by Reducing and Attenuating Velocity, Erosion and Noise.



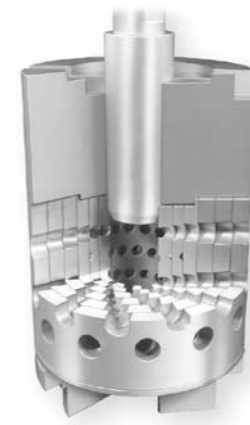
**PROVEN SUPERIOR TECHNOLOGY**

Note the highly visible attachment phenomenon wherein the flow stream hugs or clings to each obstruction in its path, effectively taking the path of least resistance. Also, despite multiple relief points in the flow path it can be clearly seen that the fluid does not recombine with the Raven trim, rather the flow streams remain virtually separate or discrete from each other for best velocity control.

**HUSH® TRIM**

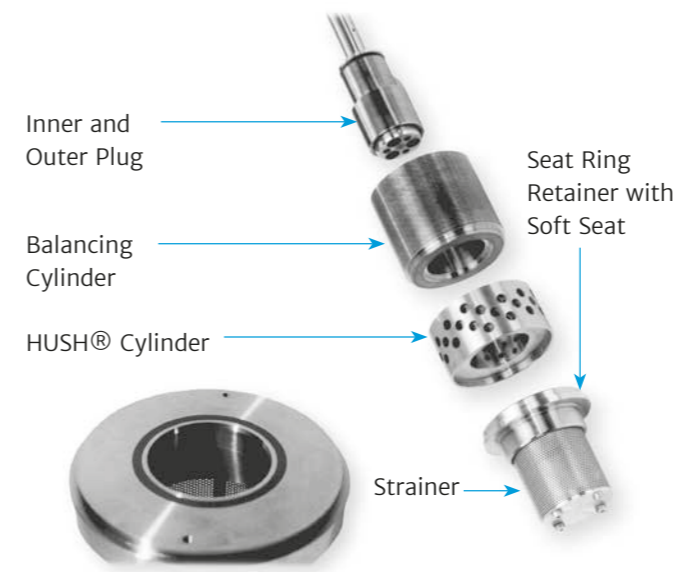
HUSH® Trim is an advanced concept in control valve trim for high pressure-drop liquid, gas and steam applications.

It is a cage guided type trim that provides excellent control for compressible and noncompressible fluid applications by directing the flow through a series of staged pressure drops. This unique trim eliminates cavitation in liquid flow and provides multiple pressure breakdown for noise attenuation in critical pressure drop compressible fluid applications.



**EXCLUSIVE SOFT SEATED HUSH™ TRIM**

Soft Seated HUSH Trim is designed for new or replacement trim in Copes-Vulcan valves as well as valves of other manufacturers. Any liquid control valve taking a pressure drop up to 5000 psi (34450 kPa) that spends more than 90% of the time in the closed position must use Soft Seated HUSH Trim to maintain zero leakage. Refer to Bulletin 142 for detailed information.



**GAD™ TRIM**

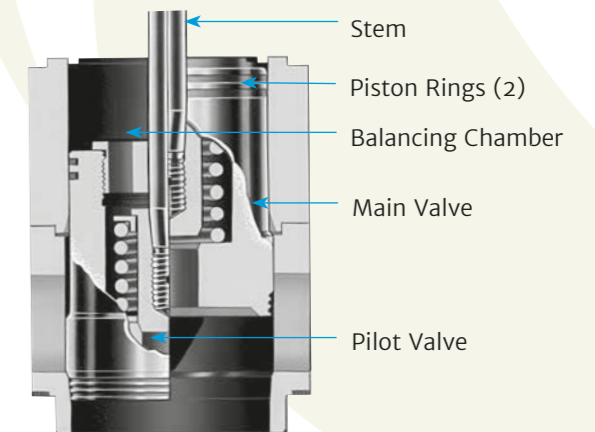
The Port Throttling GAD trim was developed to meet the rigorous requirements of feedwater startup control. Designed to give optimum flexibility in power operated control valves, the trim is available in double seat, balanced single seat, and tandem versions.

The GAD trim is equally suitable for use with steam and many other fluids. It has been successfully used on high pressure water applications involving pressure of up to 5075 psi (34970 kPa) and pressure differential of up to 3625 psi (24980 kPa).





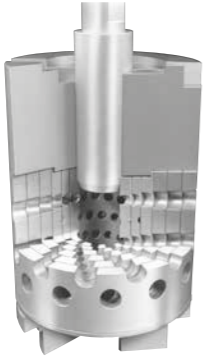

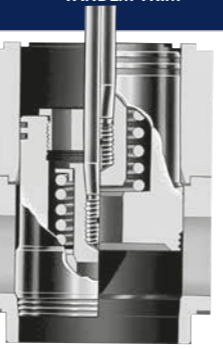
**TANDEM TRIM**

The Tandem Trim is designed primarily for high pressure differential applications where tight shutoff is essential. Such applications include steam and water pressure reduction, steam throttling to atmosphere or to a condenser, isolation, supercritical boiler startup and a variety of other uses in steam and water control systems. Refer to Bulletin 109 for detailed information.



## TRIM TYPES

A wide variety of trims is available for SD-Severe Duty Control Valves. They are designed to match virtually any severe duty/critical service operational requirement. All SD trims feature a quick-change design to reduce downtime for inspection, maintenance or change out, and most are cage guided, further ensuring smooth, accurate operation. The majority of the trim line is interchangeable between like sizes, and many reduced trims are also available as standard.

TRIM TYPES	RAVEN	HUSH™ TRIM	SOFT SEATED HUSH™ TRIM	TANDEM TRIM
				
<b>DESCRIPTION/ APPLICATION</b>	Raven is Copes-Vulcan's top-of-the-line high performance specialty trim that offers a proven solution for those severe service applications where a true velocity control trim is the best or possibly the only answer. By limiting the fluid velocities inside the valve, Raven's stacked disc design precludes problems typically associated with high velocity such as erosion, noise, vibration and poor control. Every Raven trim is custom designed to meet the needs of the toughest liquid, steam and gas services in the power and process industries.	HUSH Trim (multiple stage) is a high performance specialty trim that is cage guided and provides excellent control for both compressible and noncompressible fluid applications. By directing the flow through a series of staged pressure drops, this unique trim eliminates cavitation in liquid flow and provides multiple pressure breakdown for noise attenuation in critical pressure drop compressible fluid application. It is designed for all valve sizes.	Soft seated Hush Trim (double plug) is a high performance specialty trim that is cage guided and designed to provide and maintain extremely tight shutoff for high pressure differential liquid applications. Typically applied to operating conditions that exhibit pressure drops in excess of 1800 psig (12400 kPag) that are to remain closed more than 25% of the time. It is the ideal trim for applications such as boiler feed pump recirculation, spray block valves and spray control valves.	Tandem Trim is a high performance specialty trim that is a cage guided, uniquely balanced port throttling trim designed to solve difficult high temperature, high pressure differential applications that would require oversized, expensive actuators if more standard trims were utilized. Due to the relatively small pilot plug designed into the tandem trim, tight shutoff of up to Class V can easily be achieved with a moderately sized, economically priced actuator. It is available for valves 4" (100mm) and larger.
<b>STANDARD FCI 70-2/ANSI RATED SEAT LEAKAGE</b>	Class IV standard Class V optional *Class VI optional	Class IV standard Class V optional *Class VI optional	Class VI standard	Class IV standard Class V optional
<b>STANDARD TRIM CHARACTERISTIC</b>	Linear standard, Specials optional	Linear standard, Specials optional	Linear standard, Specials optional	Special
<b>TYPICAL FLOW DIRECTION</b>	Under the seat Over the seat	Under the seat	Over the seat	Over the seat Under the seat
<b>MAXIMUM RANGEABILITY</b>	200:1 Or greater as required	35-50:1	Under the seat	25-50:1

\* Class VI requires use of soft seat.


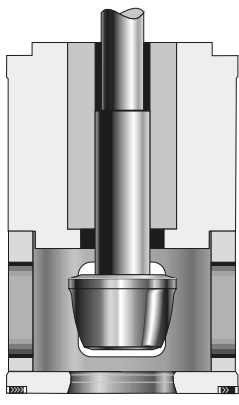
The trims shown in this bulletin represent the more common selections available. Additional standard, special and custom engineered trims can be supplied as required.

Standard stocked trim materials are 300 series and 400 series stainless steel. Other materials are available on special order.

GAD TRIM	UNBALANCED SINGLE SEAT PLUG THROTTLING	UNBALANCED SINGLE SEAT PORT THROTTLING	BALANCED SINGLE SEAT PORT THROTTLING	BALANCED SINGLE SEAT PORT THROTTLING (HI-TEMP)
				
GAD Trim is a high performance specialty trim that is cage guided and engineered to meet the rigorous requirements of feedwater control and feedwater startup control. Designed to give optimum flexibility in automated control valves, this trim is available in double seat, balanced single seat, tandem plug and one-stage Hush versions. GAD Trim is equally suitable for use with steam and many other fluids. It has been successfully used on high pressure water applications involving pressure of 5075 psi (34970 kPa) and pressure differential of up to 3625 psi (24980 kPa). It is available for valves 2" (50mm) and larger.	This trim style is a general purpose cage guided trim for on/off or modulating control. It is designed for low to moderate pressure drop applications. The solid plug has a contour on its lower end that provides varying flow area with lift, thus regulating the flow. It can be used with a wide variety of non-abrasive/non-adhesive compressible and noncompressible fluids. Standard trim for valve sizes 1.5" (40mm) and smaller.	This trim style is a general service cage guided trim for on/off or modulating control where moderate flow rates exist along with low differential pressures. The unbalanced single seat plug modulates flow by uncovering ports in the cage. The cage porting produces the pressure drop or flow control. This trim can be used in most non-abrasive/non-adhesive compressible and noncompressible fluids.	This trim style is a general purpose cage guided trim for on/off or modulating control suitable for use in most non-abrasive/non-adhesive compressible and noncompressible fluid services. The balanced plug design reduces actuator force requirements thus permitting the use of smaller, less expensive actuators while maintaining the tight shutoff capability. It is designed for valves 2" (50mm) and larger and is a standard offering when the service temperature does not exceed the 400°-500°F (204°-260°C) range, relative to pressure.	This general purpose cage guided trim is virtually identical in all respects to the balanced single seat port throttling trim except that piston rings are used in lieu of the elastomeric seal on the trim's plug. While the piston rings do limit the leakage rate to ANSI Class III, this trim is a viable option when a balanced plug is desirable and when temperatures of the fluid exceed 500°F (260°C). It is for valve sizes 2" (50mm) and larger.
Class III-IV Depending upon design selected	Class IV standard Class V optional	Class IV standard Class V optional	Class IV standard Class V optional *Class VI optional	Class IV standard
Modified parabolic, linear, equal percentage. All available as standard	Modified parabolic, linear, equal percentage.	Modified parabolic, linear, equal percentage	Modified parabolic, linear, equal percentage	Modified parabolic, linear, equal percentage
Over the seat	Under the seat	Under the seat	Over the seat	Over the seat
50:1	50:1	35-50:1	35-50:1	35-50:1

\* Class VI requires use of soft seat.

TRIM TYPES (CONT.)

TRIM TYPES	ONE STAGE HUSH	CASCADE	CAV B9®	TOP GUIDED
				
<b>DESCRIPTION/ APPLICATION</b>	One Stage Hush trim is a specialty trim designed to reduce noise associated with compressible fluids as well as to reduce the undesirable effects of flashing and cavitation that would occur with most single pressure drop trims. The Hush cage consists of a single cylinder with a large number of radially drilled orifices. The fluid exits the orifices as low energy jets resulting in significant reductions in noise or erosion. Although numerous standard designs are available, One Stage Hush is often custom engineered to provide various flow characteristics or optimal performance under specific operating conditions.	This trim style is a cage guided plug throttling trim designed primarily for high pressure drop water applications where cavitation, vibration and excessive wear occur with conventional trims. The tapered plug fits into a cage and seat with a matching taper, thus small changes in flow area occur with respect to plug travel resulting in extremely high rangeability. The labyrinth grooves machined into the plug's taper create a series of orifices which reduces the total pressure drop in a series of stages. It is especially suited to applications where small flow rates must be controlled accurately.	CAV B9 trim can be applied in liquid service where low level cavitation is evident. By utilizing flow over the seat, the radially step-drilled cage design reduces the effects of cavitation along with the associated noise and erosion problems by forcing the cavitation to occur in the center of the cage, away from all metal surfaces. In instances where flashing conditions are experienced, flow under the seat is employed with the multitude of small ports reducing both noise and erosion. Although numerous standard designs are available, the trim can be custom designed to provide various flow characteristics or optimal performance under specific flow conditions. It is available for valves 2" (50mm) and larger.	This non-cage guided trim is designed for use with a wide variety of process applications involving corrosive, erosive and viscous line fluids and many steam and water applications. It is ideal for control applications where a maximum of free flow area is desired. The trim is unbalanced, single seat, plug throttling with the plug guided by a large diameter metal or teflon insert along the lower stem area. This guiding method ensures quiet, stable, vibration free operation with pressure drops limited to 600 psi (4130 kPa) under operating conditions. Pressure drop should also be limited to avoid cavitation or flashing. It is for valve sizes 4" (100mm) and smaller.
<b>STANDARD FCI 70-2/ANSI RATED SEAT LEAKAGE</b>	Class IV standard Class V optional *Class VI optional	Class IV standard Class V optional	Class IV standard Class V optional *Class VI optional	Class IV standard Class V optional *Class VI optional
<b>STANDARD TRIM CHARACTERISTIC</b>	Linear standard Specials optional	Special	Linear standard Specials optional	Equal percentage, linear
<b>TYPICAL FLOW DIRECTION</b>	Under the seat Over the seat	Under the seat	Under the seat (for flashing) Over the seat (for cavitation)	Under the seat
<b>MAXIMUM RANGEABILITY</b>	35-100:1	200:1	35-100:1	25:1

\* Class VI requires use of soft seat.

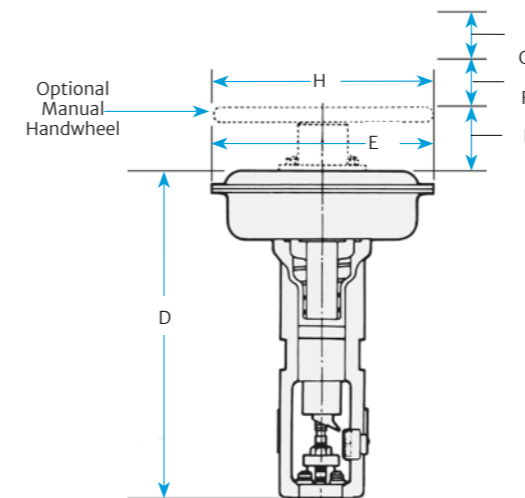
# Actuators

## MODEL 1000 ACTUATORS PNEUMATIC DIAPHRAGM — SPRING OPPOSED

Designed specifically for severe duty service, model 1000 actuators can be used in any application where shock and/or vibration are anticipated, or where seismic analysis is required. They are available with 60, 100, 160 260 and 400 in2 (390, 645, 1030, 1680 and 2580 cm2) of effective diaphragm area in both the direct and reverse acting mode. All models are available with manually operated override wheels.

To illustrate how the actuator transmits force, the shaded areas shown in the diagrams below will move during the direct and reverse acting modes. (Note the position of the diaphragm plate in each case.)

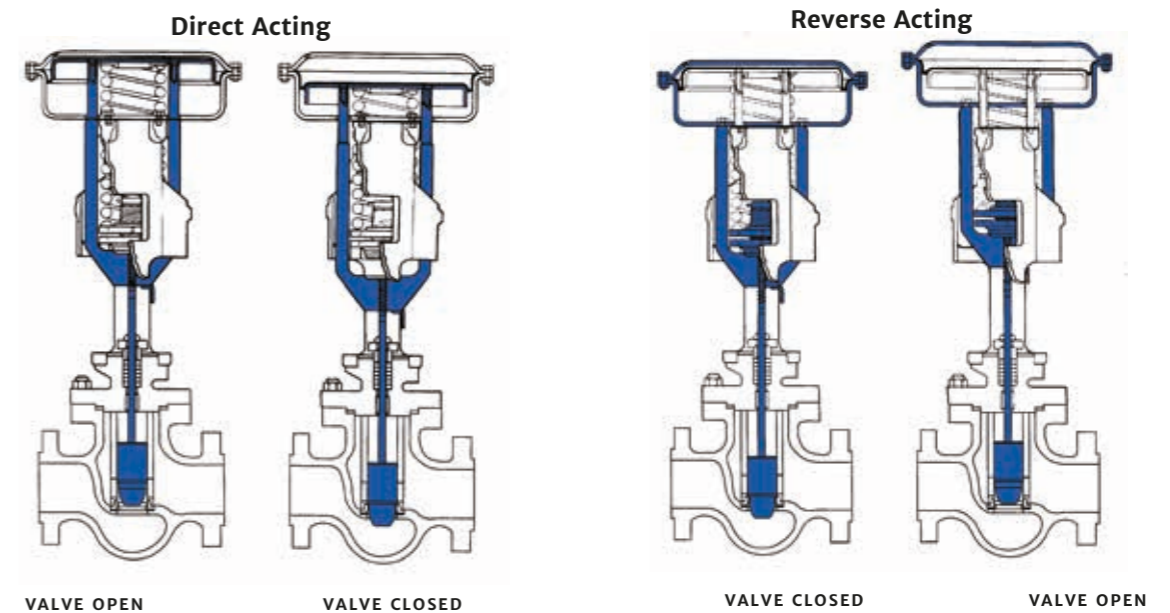
Conversion of the actuator from direct to reverse acting is accomplished simply by unfastening the diaphragm base from the frame and rotating it 90° until it is positioned above the threaded holes in the yoke. The actuator can be returned to the direct acting mode by reversing the procedure. Stem changes may be required.



Model 1000 Actuators Dimensions

ACTUATOR MODEL	D	E	F*	G**	H	I
1000-60	17.25 438	11.50 292	1.50 38	8.50 216	10.00 254	7.75 197
1000-100	25.56 649	15.12 383	3.50 89	11.25 286	18.00 457	7.75 197
1000-160	30.88 784	18.00 457	3.50 89	11.25 286	18.00 457	7.75 197
1000-400	47.25 1200	27.50 698	4.50 114	13.00 330	20.00 508	20.75 527

\*Clearance required for reverse action  
\*\* Clearance required for actuator removal



VALVE OPEN VALVE CLOSED VALVE CLOSED VALVE OPEN





## SEVERE DUTY (SD) CONTROL VALVES

- | SPEED
- | EXCELLENCE
- | PARTNERSHIP

 COPES VULCAN®

Celeros Flow Technology  
Road Two  
Industrial Estate  
Winsford, Cheshire  
CW7 3QL

P: +44 1606 552041  
F: +44 1606 558275  
E: [copeinquires@celerosft.com](mailto:copeinquires@celerosft.com)

*Celeros Flow Technology reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction, and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing. Please contact your local sales representative for product availability in your region. For more information, visit [www.celerosft.com](http://www.celerosft.com).*

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