



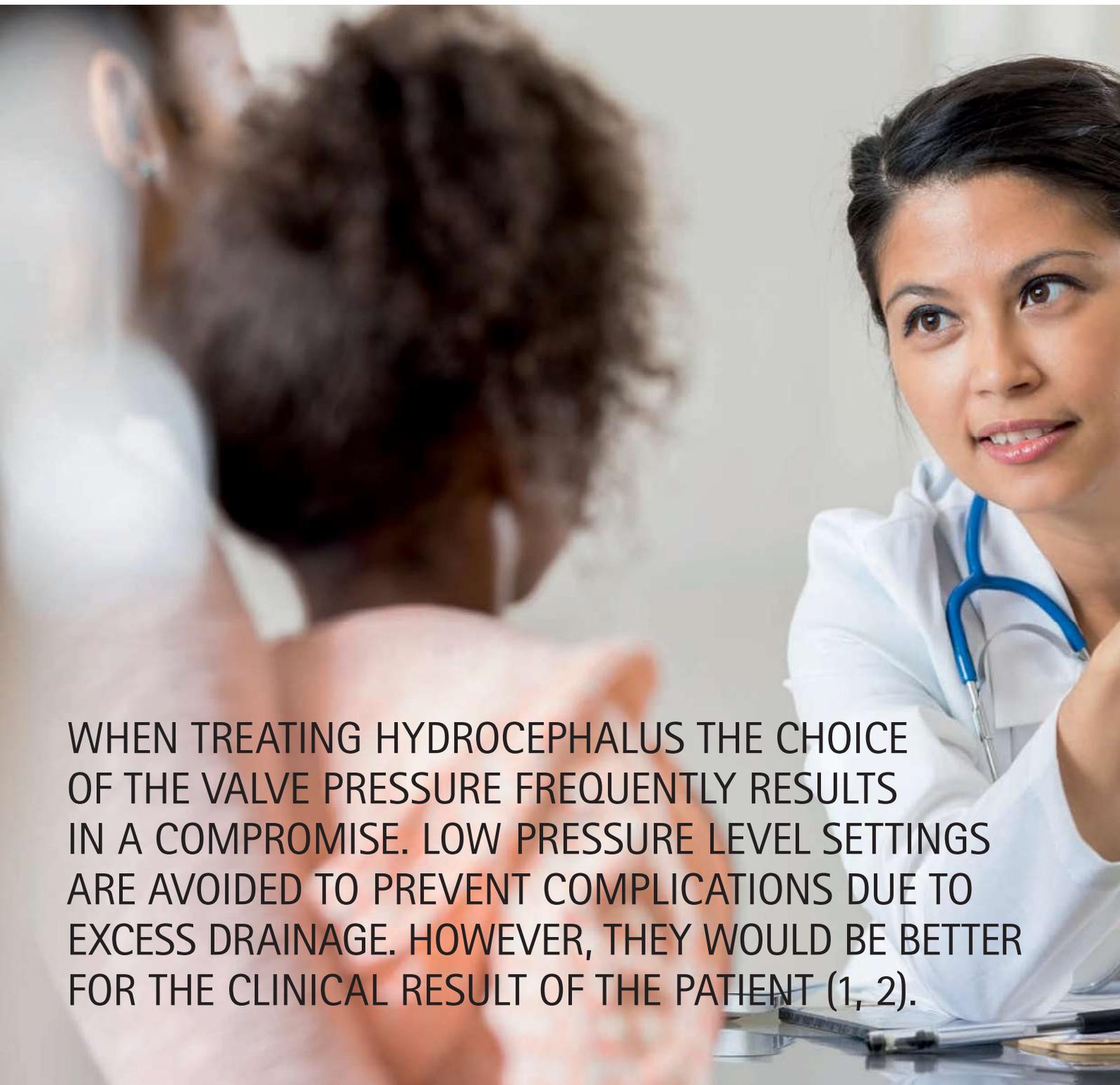
WE UNDERSTAND.



NEUROSURGERY

## ***GAV*<sup>®</sup> 2.0**

GRAVITATIONAL VALVE FOR THE TREATMENT  
OF HYDROCEPHALUS



WHEN TREATING HYDROCEPHALUS THE CHOICE OF THE VALVE PRESSURE FREQUENTLY RESULTS IN A COMPROMISE. LOW PRESSURE LEVEL SETTINGS ARE AVOIDED TO PREVENT COMPLICATIONS DUE TO EXCESS DRAINAGE. HOWEVER, THEY WOULD BE BETTER FOR THE CLINICAL RESULT OF THE PATIENT (1, 2).



Conventional valve technology provides inadequate protection against overdrainage complications such as hygroma, hematoma or slit ventricles.

Excessive drainage induced by the hydrostatic suction of the vertical shunt system is considered to be one of the major causes of shunt dysfunction in the treatment of pediatric hydrocephalus (3).



Many HC-patients suffering from chronic headaches due to excessive drainage, frequently develop an irreversible slit ventricle syndrome (4, 5).

- (1) Lemcke J, Meier U, Müller C, Fritsch MJ, Kehler U, Langer N, Kiefer M, Eymann R, Schuhmann MU, Speil A, Weber F, Remenez V, Rohde V, Ludwig HC, Stengel D. Safety and efficacy of gravitational shunt valves in patients with idiopathic normal pressure hydrocephalus: a pragmatic, randomised, open label, multicentre trial (SVASONA). *J Neurol Neurosurg Psychiatry*. 2013 Aug; 84(8):850-7.
- (2) Suchorska B, Kunz M, Schniepp R, Jahn K, Goetz C, Tonn JC, Peraud A. Optimized surgical treatment for normal pressure hydrocephalus: comparison between gravitational and differential pressure valves. *Acta Neurochir (Wien)*. 2015 Apr;157(4):703-9.
- (3) Gruber RW, Roehrig B. Prevention of ventricular catheter obstruction and slit ventricle syndrome by the prophylactic use of the Integra antisiphon device in shunt therapy for pediatric hypertensive hydrocephalus: a 25-year follow-up study. *J Neurosurg Pediatr*. 2010 Jan;5(1):4-16.
- (4) ReKate HL. Shunt-related headaches: the slit ventricle syndromes. *Childs Nerv Syst*. 2008 Apr;24(4):423-30.
- (5) Buxton N, Punt J. Subtemporal decompression: the treatment of noncompliant ventricle syndrome. *Neurosurgery*. 1999 Mar;44(3): 513-8.

# GAV<sup>®</sup> 2.0

## THE VALVE

### GRAVITATIONAL TECHNOLOGY

The combination of a differential pressure unit and gravitational unit ensures an automatic opening pressure adjustment as a function of the position of the patient's body and in that way counteracts complications due to excess drainage.



### DESIGN

The slender cylindrical design allows for quick and easy implantation in adults and in the treatment of pediatric hydrocephalus.

## TWO ADDITIONAL LP-VARIANTS

*GAV*<sup>®</sup> 2.0 is also suitable for lumbar drainage due to two special variants.

## TITANIUM

The valve material titanium assures high precision, durable reliability and biocompatibility. It prevents effectively external and subcutaneous pressure influences and is MRI compatible.

*GAV*<sup>®</sup> 2.0 LP

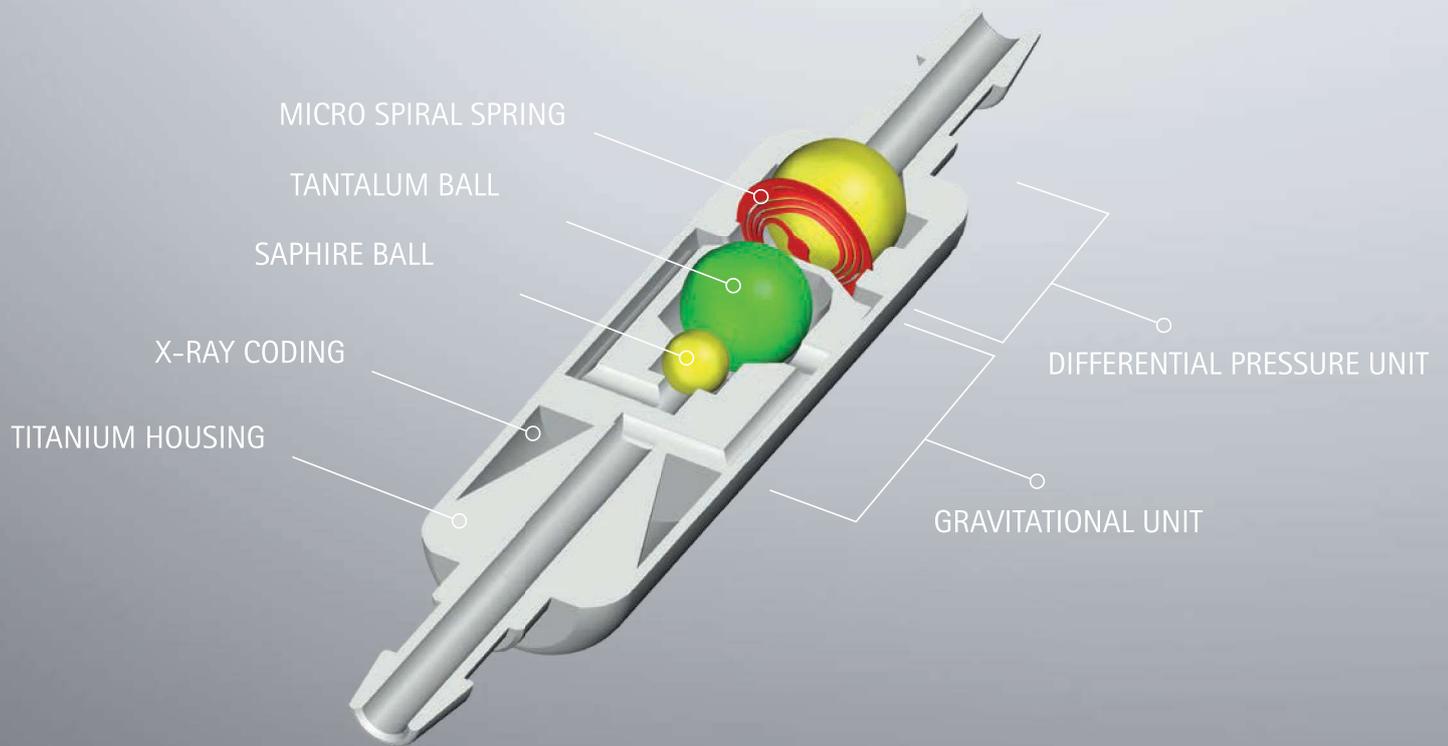


*GAV*<sup>®</sup> 2.0 LP WITH DEFLECTION



# GAV<sup>®</sup> 2.0

## FUNCTIONALITY AND POSITION OF THE BODY



The functionality of the GAV<sup>®</sup> 2.0 is illustrated interactively in the Miethke App.



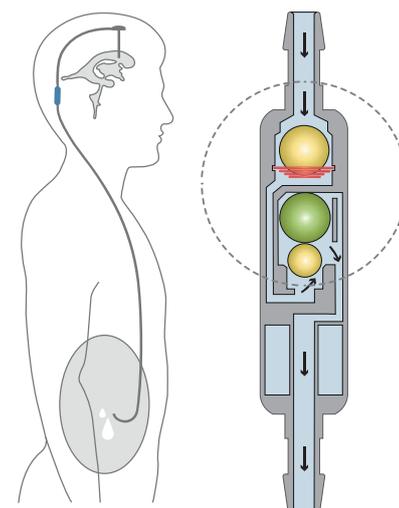
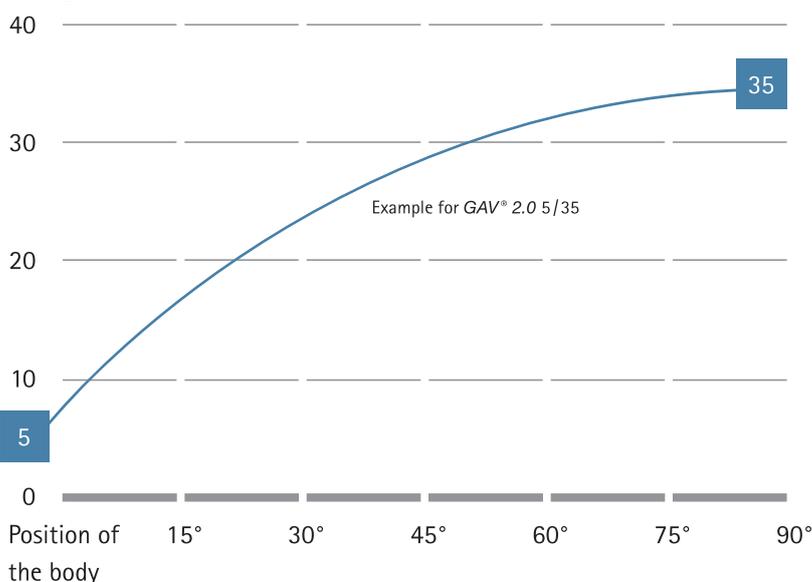
for Apple



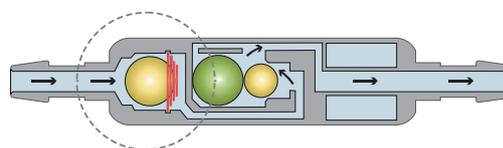
for Android



Valve opening pressure  
(cmH<sub>2</sub>O)



Differential pressure unit  
& gravitational unit  
interact in the upright  
position



In the recumbent position, only the differential pressure unit is effective

#### HORIZONTAL POSITION OF THE BODY

The valve opening pressure of GAV® 2.0 in the lying position is solely determined by the micro spiral spring of the differential pressure unit. The gravitational unit is not active in this body position and is always open. If the patient's intraventricular pressure (IVP) exceeds the opening pressure of the micro spiral spring, the closure ball moves out of the cone, opening a gap for drainage purposes.

For the example, a differential pressure unit of 5 cmH<sub>2</sub>O was selected.

#### VERTICAL POSITION OF THE BODY

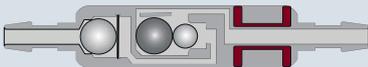
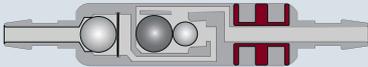
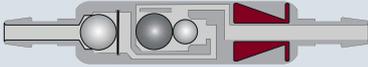
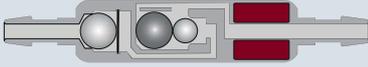
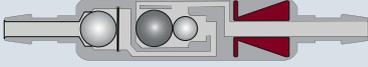
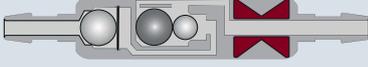
In the vertical position of the body, the gravitational and differential pressure units act in conjunction. When the patient stands up, the tantalum ball (green) in the gravitational unit is activated, causing gravity to increase the valve opening pressure. Now, the weight of the tantalum ball (opening pressure of the gravitational unit) must be overcome in addition to the opening pressure of the differential pressure unit. Only when the sum of intraventricular pressure (IVP) and hydrostatic pressure exceeds the opening pressure of both units, drainage can take place again. The opening pressure in the upright position of the patient is therefore computed from the sum of the differential pressure and gravitational pressure.

For the example, a gravitational unit having 30 cmH<sub>2</sub>O was selected. The total opening pressure in the upright position thus adds up to 35 cmH<sub>2</sub>O.

# GAV<sup>®</sup> 2.0

## X-RAY RECOGNITION AND PRESSURE LEVEL RECOMMENDATION

### PRESSURE LEVEL VARIANTS

Lying	Upright	X-ray coding	Radiograph
5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O		
5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O		
5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O		
5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O		
10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O		
10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O		

## PRESSURE LEVEL RECOMMENDATION \*

NEW BORN	CHILDREN > 6 MONTHS	CHILDREN > 3 YEARS	ADULTS	ADULTS > 65 YEARS
5/25	10/25	10/30	5/30 5/25 < 1.60 m 5/35 > 1.80 m	5/25 5/20 < 1.60 m 5/30 > 1.80 m

\* Recommended pressure level in cmH<sub>2</sub>O.

This is a non-binding recommendation. The doctor will decide each case on an individual basis.

The choice of the appropriate pressure level of *GAV*<sup>®</sup> 2.0 depends on several other factors, including age, degree of activity, size and stature of the patient.

The values given apply to mobile patients. For patients with little mobility or a high BMI, the gravitational unit should be chosen lower than recommended here.

# GAV<sup>®</sup> 2.0

## GAV<sup>®</sup> 2.0 VALVE

### ■ GAV<sup>®</sup> 2.0 Valve



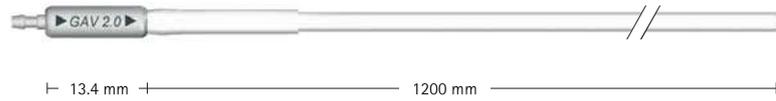
Valve:  $d_o = 4.2$  mm  
Connector:  $d_o = 1.9$  mm  
preferably used with  
Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm

Art. No.	Lying	Upright
FX210T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX211T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX212T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX213T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX214T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX215T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

## GAV® 2.0 VALVE WITH DISTAL CATHETER

- GAV® 2.0 Valve  
with distal catheter (1200 mm)



Valve:  $d_o = 4.2$  mm  
 Connector:  $d_o = 1.9$  mm  
 Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm

Art. No.	Lying	Upright
FX216T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX217T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX218T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX219T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX220T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX221T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

# GAV<sup>®</sup> 2.0

## GAV<sup>®</sup> 2.0 SHUNT SYSTEM WITH CONTROL RESERVOIR

- GAV<sup>®</sup> 2.0 Valve with integrated CONTROL RESERVOIR\* and distal catheter (1200 mm)

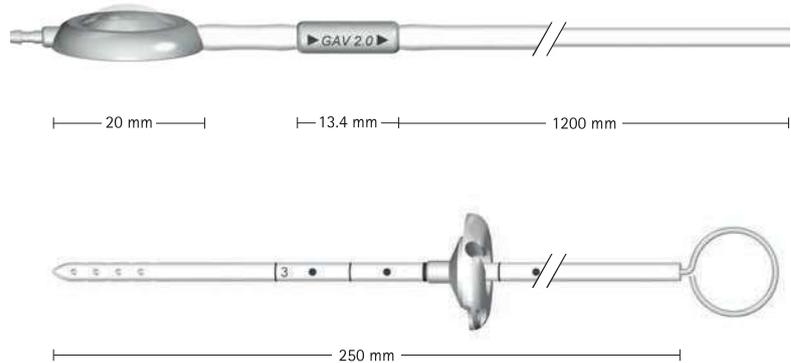
- Ventricular catheter with pediatric deflector and introducing stylet (250 mm)

\* An additional valve in the base of the CONTROL RESERVOIR makes it possible to flush the fluid only in the distal direction. This feature allows for controlling the patency of the ventricular catheter and the distal drainage.

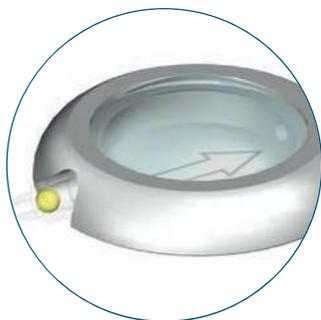
Valve:  $d_o = 4.2$  mm

Connector:  $d_o = 1.9$  mm

Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm



### 16.2



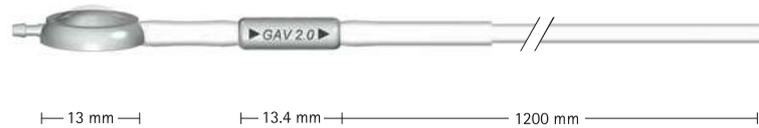
CONTROL RESERVOIR\*

Art. No.	Lying	Upright
FX146T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX147T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX148T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX149T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX150T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX151T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

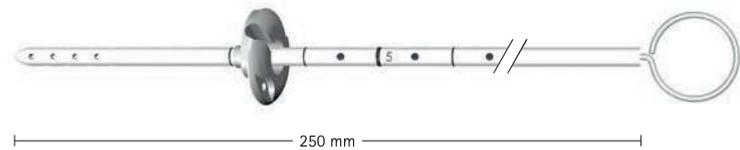
For pressure level recommendation see page 9.

## GAV® 2.0 SHUNT SYSTEM WITH PEDIATRIC CONTROL RESERVOIR

- GAV® 2.0 Valve with integrated pediatric CONTROL RESERVOIR\* and distal catheter (1200 mm)



- Ventricular catheter with pediatric deflector and introducing stylet (250 mm)

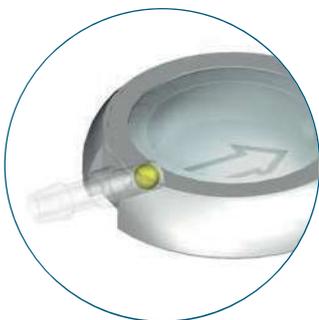


\* An additional valve in the base of the pediatric CONTROL RESERVOIR makes it possible to flush the fluid only in the distal direction. This feature allows for controlling the patency of the ventricular catheter and the distal drainage.

Valve:  $d_o = 4.2$  mm

Connector:  $d_o = 1.9$  mm

Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm



pediatric CONTROL RESERVOIR\*

Art. No.	Lying	Upright
FX152T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX153T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX154T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX155T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX156T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX157T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

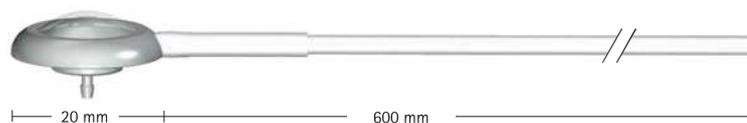
# GAV<sup>®</sup> 2.0

## GAV<sup>®</sup> 2.0 SHUNT SYSTEM WITH SPRUNG RESERVOIR

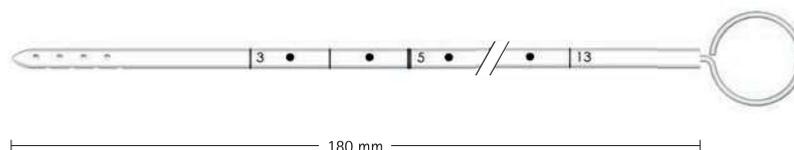
- GAV<sup>®</sup> 2.0 Valve with distal catheter (1200 mm)



- SPRUNG RESERVOIR\* with distal catheter (600 mm)



- Ventricular catheter with introducing stylet (180 mm)

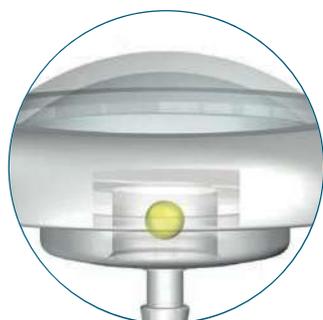


\* An additional valve in the base of the SPRUNG RESERVOIR makes it possible to flush the fluid only in the distal direction. This feature allows for controlling the patency of the ventricular catheter and the distal drainage.

Valve:  $d_o = 4.2$  mm

Connector:  $d_o = 1.9$  mm

Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm



SPRUNG RESERVOIR\*

Art. No.	Lying	Upright
FX270T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX271T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX272T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX273T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX274T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX275T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

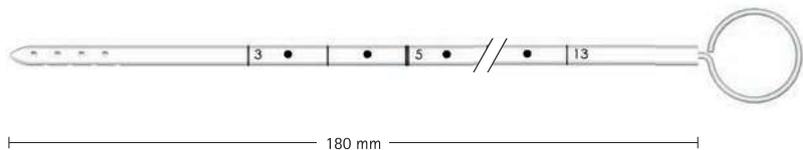
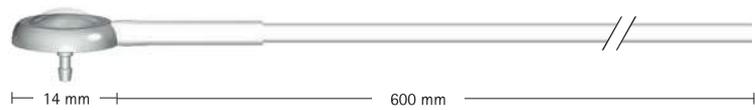
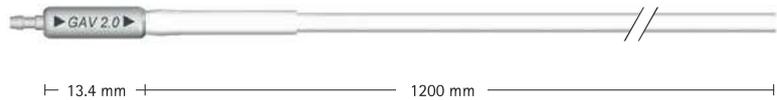
For pressure level recommendation see page 9.

# GAV® 2.0 SHUNT SYSTEM WITH PEDIATRIC SPRUNG RESERVOIR

- GAV® 2.0 Valve  
with distal catheter (1200 mm)
- Pediatric SPRUNG RESERVOIR\*  
with distal catheter (600 mm)
- Ventricular catheter with  
introducing stylet (180 mm)

\* An additional valve in the base of the pediatric SPRUNG RESERVOIR makes it possible to flush the fluid only in the distal direction. This feature allows for controlling the patency of the ventricular catheter and the distal drainage.

Valve:  $d_o = 4.2$  mm  
 Connector:  $d_o = 1.9$  mm  
 Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm



pediatric SPRUNG RESERVOIR\*

14.

Art. No.	Lying	Upright
FX276T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX277T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX278T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX279T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX280T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX281T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

# GAV<sup>®</sup> 2.0

## GAV<sup>®</sup> 2.0 SHUNT SYSTEM WITH *SPRUNG RESERVOIR*

- GAV<sup>®</sup> 2.0 Valve with integrated *SPRUNG RESERVOIR*\* and distal catheter (1200 mm)

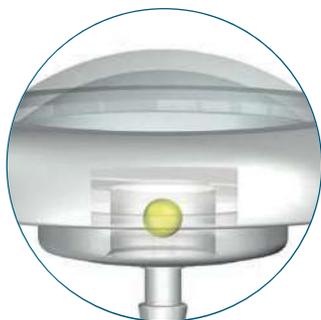
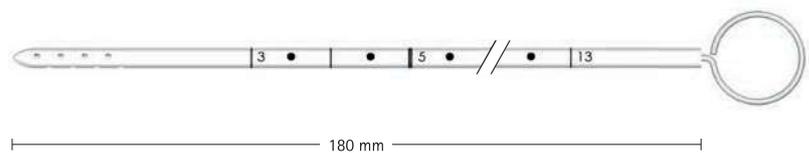
- Ventricular catheter with introducing stylet (180 mm)

\* An additional valve in the base of the *SPRUNG RESERVOIR* makes it possible to flush the fluid only in the distal direction. This feature allows for controlling the patency of the ventricular catheter and the distal drainage.

Valve:  $d_o = 4.2$  mm

Connector:  $d_o = 1.9$  mm

Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm



*SPRUNG RESERVOIR*\*

Art. No.	Lying	Upright
FX170T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX171T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX172T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX173T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX174T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX175T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

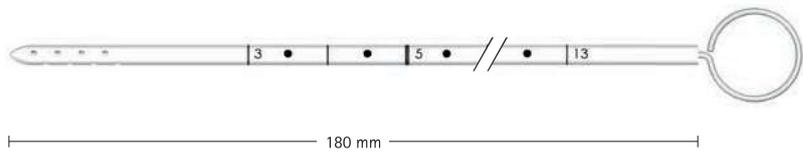
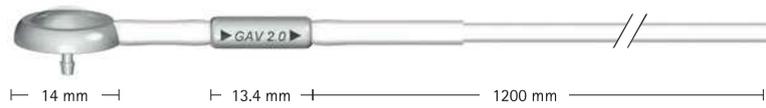
For pressure level recommendation see page 9.

# GAV® 2.0 SHUNT SYSTEM WITH PEDIATRIC SPRUNG RESERVOIR

- GAV® 2.0 Valve with integrated pediatric SPRUNG RESERVOIR\* and distal catheter (1200 mm)
- Ventricular catheter with introducing stylet (180 mm)

\* An additional valve in the base of the pediatric SPRUNG RESERVOIR makes it possible to flush the fluid only in the distal direction. This feature allows for controlling the patency of the ventricular catheter and the distal drainage.

Valve:  $d_o = 4.2$  mm  
 Connector:  $d_o = 1.9$  mm  
 Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm



pediatric SPRUNG RESERVOIR\*

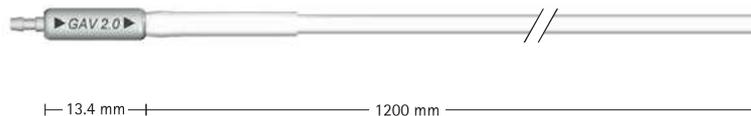
Art. No.	Lying	Upright
FX176T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX177T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX178T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX179T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX180T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX181T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

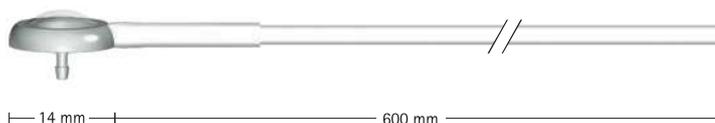
# GAV<sup>®</sup> 2.0

## GAV<sup>®</sup> 2.0 SHUNT SYSTEM WITH PEDIATRIC BURRHOLE RESERVOIR

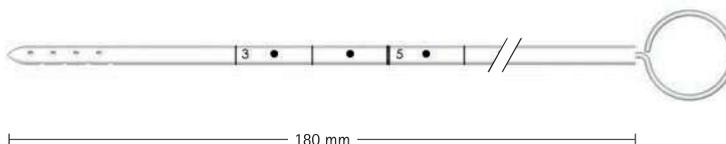
- GAV<sup>®</sup> 2.0 Valve with distal catheter (1200 mm)



- Pediatric burrhole reservoir with distal catheter (600 mm)



- Ventricular catheter with introducing stylet (180 mm)



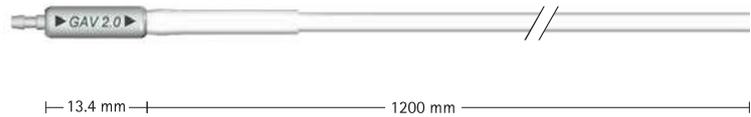
Valve:  $d_o = 4.2$  mm  
 Connector:  $d_o = 1.9$  mm  
 Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm

Art. No.	Lying	Upright
FX264T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX265T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX266T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX267T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX268T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX269T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

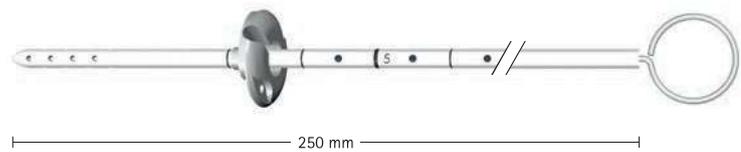
For pressure level recommendation see page 9.

## GAV® 2.0 SHUNT SYSTEM

- GAV® 2.0 Valve with distal catheter (1200 mm)



- Ventricular catheter with pediatric deflector and introducing stylet (250 mm)



Valve:  $d_o = 4.2$  mm  
 Connector:  $d_o = 1.9$  mm  
 Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm

Art. No.	Lying	Upright
FX204T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX205T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX206T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX207T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX208T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX209T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

# GAV<sup>®</sup> 2.0 LP

## GAV<sup>®</sup> 2.0 LP, STRAIGHT

- GAV<sup>®</sup> 2.0 LP Valve (straight) with distal catheter (1200 mm)



Valve:  $d_o = 4.2$  mm  
Connector:  $d_o = 1.4$  mm  
for connection with lumbar catheter  
Connector:  $d_o = 1.9$  mm  
Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm

Art. No.	Lying	Upright
FX222T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX223T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX224T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX225T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX226T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX227T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

## GAV® 2.0 LP, U-FORM

- GAV® 2.0 LP Valve (U-Form)  
with distal catheter (1200 mm)



Valve:  $d_o = 4.2$  mm  
 Connector:  $d_o = 1.4$  mm  
 for connection with lumbar catheter  
 Connector:  $d_o = 1.9$  mm  
 Catheter:  $d_i = 1.2$  mm,  $d_o = 2.5$  mm

Art. No.	Lying	Upright
FX228T	5 cmH <sub>2</sub> O	20 cmH <sub>2</sub> O
FX229T	5 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX230T	5 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O
FX231T	5 cmH <sub>2</sub> O	35 cmH <sub>2</sub> O
FX232T	10 cmH <sub>2</sub> O	25 cmH <sub>2</sub> O
FX233T	10 cmH <sub>2</sub> O	30 cmH <sub>2</sub> O

For pressure level recommendation see page 9.

# OUR SHUNT SYSTEMS – YOUR CHOICE

<i>proSA®</i>	<i>proGAV® 2.0</i>	<i>GAV® 2.0</i>	<i>SHUNT-ASSISTANT® 2.0 Valve</i>	<i>DUALSWITCH Valve</i>	<i>miniNAV®</i>	<i>Accessories</i>
						

Description	
Adjustable gravitational unit with differential pressure valve	Differential pressure valve, specifically for premature babies and newborns or bedridden or non-mobile patients
Adjustable differential pressure valve with gravitational unit	Gravitational valve with large flow volumes for CSF
Gravitational valve for the treatment of hydrocephalus	Gravitational unit for integration into shunt systems in order to avoid excess drainage

Indication	
LP	✓
NPH	✓
Pediatric HC	✓
Adult HC	✓

Patient	
Lying	✓
Active	*

Feature	
3-Tesla MR Conditional	✓
Gravitational unit	✓
Adjustable	✓

\* in combination with SHUNTASSISTANT® 2.0 or proSA®



NEUROSURGERY

# WE UNDERSTAND THE GRAVITY OF THE SITUATION.

GRAVITATIONAL VALVES BY MIETHKE

AESCULAP® – a B. Braun brand





# *SENSOR RESERVOIR*

# *SENSOR PRECHAMBER*

TELEMETRIC SHUNT CONTROL – READING INNER VALUES

AESCULAP® – a B. Braun brand

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Manufacturer acc. to MDD 93/42/EEC

■ **CHRISTOPH MIETHKE GMBH & CO. KG**

Christoph Miethke GmbH & Co. KG | Ulanenweg 2 | 14469 Potsdam | Germany  
Phone +49 331 62083-0 | Fax +49 331 62083-40 | [www.miethke.com](http://www.miethke.com)

## AESCULAP<sup>®</sup> – a B. Braun brand

Distributed by

Aesculap AG | Am Aesculap-Platz | 78532 Tuttlingen | Germany  
Phone +49 7461 95-0 | Fax +49 7461 95-2600 | [www.aesculap.com](http://www.aesculap.com)

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