1 Especificación

[*PROCESS*]

state ::= *locked* | *unlocked*

response ::= *ok* | *cantBeLessThanOne* | *cantAllowMoreReaders*
| *cantLockWithNullProcess* | *lockedByReader* | *errorReadNotAcquired*
| *lockedByWriter* | *cantSetLessThanActualReaders*
| *errorWriteLockedByOtherProcess* | *errorWriteNotLocked*

| *nullProcess* : *PROCESS*

ReadersWriterLock
readers : $\mathbb{P}\, PROCESS$
writerLockState : *state*
writer : *PROCESS*
maxReaders : $\mathbb{Z}$

InvMaxReadersPositive
ReadersWriterLock

maxReaders > 0

InvReadersLessThanMaxReaders
ReadersWriterLock

$\#readers \leq maxReaders$

InvNoReadersWhileWriter
ReadersWriterLock

$writerLockState = locked \Rightarrow readers = \emptyset$

ReadersWriterLockInit
ReadersWriterLock

$readers = \emptyset$
writerLockState = *unlocked*
writer = *nullProcess*
maxReaders = 1

– BLOQUE SET READER MAX

```
┌─ SetMaxReadersOk ──────────────────────────────────────────
│ ΔReadersWriterLock
│ n? : ℤ
│ res! : response
├────────────────────────────
│ n? ≥ 1
│ #readers ≤ n?
│ maxReaders′ = n?
│ res! = ok
└────────────────────────────────────────────────────────────
```

```
┌─ MaxReadersIncorrectValue ─────────────────────────────────
│ ΞReadersWriterLock
│ n? : ℤ
│ res! : response
├────────────────────────────
│ n? < 1
│ res! = cantBeLessThanOne
└────────────────────────────────────────────────────────────
```

```
┌─ LessThanActualReaders ────────────────────────────────────
│ ΞReadersWriterLock
│ n? : ℤ
│ res! : response
├────────────────────────────
│ n? < #readers
│ res! = cantBeLessThanActualReaders
└────────────────────────────────────────────────────────────
```

$SetMaxReadersErrors == LessThanActualReaders$
$\quad \lor\ MaxReadersIncorrectValue$

$SetMaxReaders == SetMaxReadersOk \lor SetMaxReadersErrors$

– ERRORES GENERICOS

```
┌─ ProcessIsWriting ─────────────────────────────────────────
│ ΞReadersWriterLock
│ res! : response
├────────────────────────────
│ writerLockState = locked
│ res! = lockedByWriter
└────────────────────────────────────────────────────────────
```

```
┌─ ProcessIsReading ─────────────────────────────────────────
│ ΞReadersWriterLock
│ res! : response
├────────────────────────────
│ readers ≠ ∅
│ res! = lockedByReader
└────────────────────────────────────────────────────────────
```

```
CantLockWithNullProcess
ΞReadersWriterLock
p? : PROCESS
res! : response

p? = nullProcess
res! = cantLockWithNullProcess
```

– BLOQUE ACQUIRE READ

```
AcquireReadOk
ΔReadersWriterLock
p? : PROCESS
res! : response

writerLockState = unlocked
#readers + 1 ≤ maxReaders
readers' = readers ∪ {p?}
res! = ok
```

```
MaxReadersReached
ΞReadersWriterLock
res! : response

#readers = maxReaders
res! = cantAllowMoreReaders
```

$AcquireReadError == MaxReadersReached \lor ProcessIsWriting$
$\lor\ CantLockWithNullProcess$

$AcquireReader == AcquireReadOk \lor AcquireReadError$

– BLOQUE ACQUIRE WRITE

```
AcquireWriteOk
ΔReadersWriterLock
p? : PROCESS
res! : response

writerLockState = unlocked
readers = ∅
writer' = p?
writerLockState' = locked
res! = ok
```

$AcquireWriteError == ProcessIsReading \lor ProcessIsWriting$
$\quad \lor CantLockWithNullProcess$

$AcquireWrite == AcquireWriteOk \lor AcquireWriteError$

– BLOQUE RELEASE READ

```
┌─ ReleaseReadOk ──────────────────────────────
│ ΔReadersWriterLock
│ p? : PROCESS
│ res! : response
├──────────────────────────────────────────────
│ p? ∈ readers
│ readers' = readers \ {p?}
│ res! = ok
└──────────────────────────────────────────────
```

```
┌─ ReadNotAcquired ────────────────────────────
│ ΞReadersWriterLock
│ p? : PROCESS
│ res! : response
├──────────────────────────────────────────────
│ p? ∉ readers
│ res! = errorReadNotAcquired
└──────────────────────────────────────────────
```

$ReleaseRead == ReleaseReadOk \lor ReadNotLocked$

– BLOQUE RELEASE WRITE

```
┌─ ReleaseWriteOk ─────────────────────────────
│ ΔReadersWriterLock
│ p? : PROCESS
│ res! : response
├──────────────────────────────────────────────
│ writerLockState = locked
│ writer = p?
│ writerLockState' = unlocked
│ writer' = nullProcess
│ res! = ok
└──────────────────────────────────────────────
```

```
┌─ WriteNotLocked ─────────────────────────────
│ ΞReadersWriterLock
│ res! : response
├──────────────────────────────────────────────
│ writerLockState = unlocked
│ res! = errorWriteNotLocked
└──────────────────────────────────────────────
```

4

```
┌─ LockedByOtherProcess ─────────────────────────────────
│ ΞReadersWriterLock
│ p? : PROCESS
│ res! : response
├────────────────
│ writerLockState = locked
│ writer ≠ p?
│ res! = errorWriteLockedByOtherProcess
└─────────────────────────────────────────────────────────
```

$ReleaseWriteError == WriteNotLocked \lor LockedByOtherProcess$
$ReleaseWrite == ReleaseWriteOk \lor ReleaseWriteError$